316(b) Application Addendum
Permit Number: GMG290132

Big Foot Tension Leg Platform

Chevron U.S.A. Inc.

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INTRODUCTION

Chevron U.S.A. Inc. (Chevron) proposes to construct and operate the Big Foot Tension Leg Platform (TLP) in Block 29 of the Walker Ridge exploration area in the western Gulf of Mexico (GOM; Figure 1). The Big Foot TLP will use once-through cooling water as part of its normal operations. This permit application addendum is being submitted to the United States Environmental Protection Agency (USEPA) to address requirements set forth by regulations under Section 316(b) of the Clean Water Act (CWA), 33 U.S.C. 1326(b) to address concerns of Cooling Water Intake Structures (CWIS) on impingement and entrainment (IM&E) of vulnerable marine organisms. This permit application addendum is submitted in accordance with the provisions of the National Pollutant Discharge Elimination System (NPDES) permitting regulations as set forth in Title 40 of the Code of Federal Regulations (CFR) at §122.21. Specifically, this permit application addendum is intended to satisfy the requirements cited under the NPDES General Permit for New and Existing Sources and New Dischargers in the Offshore Subcategory of the Oil & Gas Extraction Category for the Western Portion of the Outer Continental Shelf of the Gulf of Mexico (GMG290000) (General Permit). The order of this addendum follows that of the General Permit requirements.

§I.B.12.a - APPLICATION INFORMATION

§I.B.12.a.1 - New Non-Fixed Facilities

The Big Foot TLP is a fixed facility. Therefore, the requirements of §I.B.12.a.1 do not apply.

§I.B.12.a.2 - New Fixed Facilities

§I.B.12.a.2.i - Baseline Study Requirements

Operators of applicable CWIS must submit sufficient information to characterize the biological community of commercial, recreational, and forage base fish and shellfish in the vicinity of the intake structure and to characterize the effects of the CWIS operation on aquatic life. The biological characterization must include any available existing information along with field studies to obtain localized data. Alternatively, operators may comply with the requirements by participating in an industry-wide study.

The Offshore Operators Committee (OOC) conducted an industry-wide study in September 2009 to provide a comprehensive review of fishery data for the GOM and to evaluate the impacts of future CWIS on fish and shellfish in the GOM. The OOC industry-wide study was approved by EPA, Region 6 in October 2009. The OOC industry-wide study concluded:

"In general, the greatest biological concentration of key marine species, including their spawning habitat, is restricted to the waters of the continental shelf (<200 meter in depth) of the GOM. There is no projected CWIS development for this area. All CWIS development is projected for deeper areas of the continental shelf (200-1,000 meter water depths) and the abyssal plain (>1,000 meter). Of the few species that reproductively occupy these deeper waters and for which there is sufficient life-history data available, entrainment losses are estimated to be nominal. Overall, the new seawater use scenario examined in this study would have minimal impacts on the species assessed."

Chevron participated in the OOC industry-wide study. As such, the following information summarizes the findings in the OOC industry-wide study and focuses on the biological characterization and the effects of the CWIS on aquatic life in the specific location for the CWIS where the entrainment could possibly occur. The location of the Big Foot TLP will be in the GOM approximately 150 miles from the Louisiana shoreline. This area of the GOM is considered to be part of the continental slope which is between the continental shelf and the GOM basin at a depth of approximately 5,250 feet. The CWIS will withdraw water from approximately 112 feet below the surface water.

§I.B.12.a.2.i.(a) - List of the data required by this section that are not available and efforts made to identify sources of the data

A comprehensive review of literature was conducted, including a list of species for all life stages and their relative abundance, life histories, list of threatened and endangered species, etc. The relevant literature is consistent with the information provided in the OOC industry-wide study. It was concluded that the existing information included in the literature supports the OOC study and is sufficient to characterize the biological community and effects of the CWIS's operation on aquatic life. Therefore, no additional data or efforts to collect additional data are required.

§I.B.12.a.2.i.(b) - List of species (or relevant taxa) for all life stages and their relative abundance in the vicinity of the cooling water intake structure

The continental slope that will surround the Big Foot TLP area supports a varied and abundant fish fauna. Distinctive fish assemblages can be recognized within broad habitat classes for the continental slope waters as follows: bottom fishes, reef fishes, and pelagic fishes. The most significant fishes for this assessment are the pelagic fishes because the CWIS will only withdraw water from an area where mostly pelagic fishes frequent. There are approximately 45 species and 17 families of pelagic fishes associated with offshore platforms in the GOM:

Family Carcharhinidae	Spinner shark (*Carcharhinus brevipinna*)
	Blacktip shark (*Carcharhinus limbatus*)
	Dusky shark (*Carcharhinus obscurus*)
	Tiger shark (*Galeocerdo cuvier*)
	Atlantic sharpnose (*Rhizoprionodon terraenovae*)
Family Sphyrnidae	Great hammerhead shark (*Sphyrna mokarran*)
	Smooth hammerhead shark (*Sphyrna zygaena*)
Family Elopidae	Atlantic tarpon (*Megalops atlanticus*)
Family Clupeidae	Scaled sardine (*Harengula jaguana*)
	Round Sardinella (*Sardinella aurita*)
Family Pomatomidae	Bluefish (*Pomatomus saltatrix*)
Family Rachycentridae	Cobia (*Rachycentron canadum*)
Family Echeneidae	Live sharksucker (*Echeneis naucrates*)
Family Carangidae	Blue runner (*Caranx fuscus*)
	Crevalle jack (*Caranx hippos*)
	Horse-eye jack (*Caranx latus*)
	Black jack (*Caranx lugubris*)
	Bar jack (*Caranx ruber*)
	Round scad (*Decapterus punctatus*)
	Rainbow runner (*Elagatis bipinnulata*)
	Lookdown (*Selene vomer*)
	Greater amberjack (*Seriola dumerili*)
	Lesser amberjack (*Seriola fasciata*)
	Almaco jack (*Seriola rivoliana*)
	Rudderfish (*Seriola zonata*)
	Florida pompano (*Trachinotus carolinus*)
	Rough scad (*Trachurus lathami*)
Family Coryphaenidae	Dolphinfish(*Coryphaena hippurus*)
Family Lobotidae	Atlantic tripletail (*Lobotes surinamensis*)
Family Ephippidae	Atlantic spadefish (*Chaetodipterus faber*)
Family Mugilidae	Flathead mullet (*Mugil cephalus*)
Family Sphyraenidae	Barracuda (*Sphyraena barracuda*)
Family Scombridae	Wahoo (*Acanthocybium solandri*)
	Little tunny (*Euthynnus alletteratus*)
	Striped bonito (*Euthynnus pelamis*)
	King mackerel (*Scomberomorus cavalla*)
	Atlantic Spanish mackerel (*Scomberomorus maculatus*)
	Yellowfin tuna (*Thunnus albacares*)
	Blackfin tuna (*Thunnus atlanticus*)
	Atlantic bluefin tuna (*Thunna thynnus*)
Family Istiophoridae	Atlantic blue marlin (*Makaira nigricans*)
	White marlin (*Tetrapterus albidus*)

Family Balistidae	Grey triggerfish (*Balistis capriscus*)
	Ocean triggerfish (*Canthidermis sufflamen*)
Family Tetraodontidae	Smooth puffer (*Lagocephalus laevigatus*)

The most abundant pelagic fishes at offshore platforms tend to be bluefish, Atlantic spadefish, blue runner, Crevalle jack, lookdown, greater amberjack, and Almaco jack. The most abundant large predators tend to be barracuda, cobia, and hammerhead sharks. Most of the large predators do not appear to be permanent residents of platforms, but rather believed to be highly transient and migratory.

In addition, there are many species of bottom fishes, coastal fishes, and shellfish which may not occupy the water column as adults in the vicinity of the CWIS, but nevertheless may have eggs or larvae that may migrate with the prevailing water currents and become entrained in the CWIS. The OOC industry-wide study provides a list of important commercial and recreational species which may be present in the vicinity of the CWIS as either zooplankton or ichthyoplankton:

Brown shrimp (*Farfantepenaeus aztecus*)
White shrimp (*Litopenaeus setiferus*)
American oyster (*Crassostrea virginica*)
Gulf menhaden (*Brevoortia patronus*)
Blue crab (*Callinectes sapidus*)
Pink shrimp (*Farfantepenaeus duorarum*)
Gulf stone crab (*Menippe adina)*
Red grouper (*Ephinephelus morio*)
Red snapper (*Lutjanus campechanus*)
Red drum (*Sciaenops ocellatus*)
Spotted seatrout (*Cynoscion nebulosus*)
Anchovies (family Engraulidae)

§I.B.12.a.2.i.(c) - Identification of the species and life stages that would be most susceptible to IM&E. Species evaluated should include the forage base as well as those most important in terms of significance to commercial and recreational fisheries

<u>Commercial Fisheries</u>

The marine fisheries in the GOM include both migratory pelagic species and reef fishes. The most important commercial pelagic fishes include Spanish mackerel, king mackerel, dolphinfish, cobia, and yellowfin tuna. Spanish mackerel and king mackerel tend to form large schools and comprise the majority of harvested species. The highest abundance of all species occurs in summer and fall. Adult pelagic fishes are not candidates for entrainment in the CWIS due to their size and ability to swim away from the CWIS.

With regard to commercial fisheries, the OOC industry-wide study assessed the most commercially-important species (based on dollar value of annual landings) in the GOM. According to the OOC industry-wide study, of the top eleven species harvested in the GOM, the top nine species all have shallow water distributions and would not be affected by the CWIS. The two remaining species are red snapper and yellowfin tuna whose eggs and larvae could be entrained in the CWIS, but at very nominal occurrences. There are fifteen species of shark that are fished commercially in the GOM; however, each one has reproductive strategies that would not make them subject to egg and larvae entrainment.

Yellowfin tuna is a large pelagic fish found year round throughout the continental shelf in the GOM. Yellowfin tuna have a life span 6-7 years. Females are multiple spawners with average annual spawning frequency of 45 times and an average of 1-4 million eggs per batch. Yellowfin tuna spawn from May to September so that eggs and larvae would be exposed to CWIS entrainment for total of five months.

Red snapper is a commercially-important fish and occurs throughout the continental shelf in the GOM. Red snapper is a demersal species found over sandy bottoms, around reefs, and underwater platforms at depths between 0 and 200 meters. Red snapper is a long-lived fish which can live up to 50 years. Spawning occurs in offshore waters from May through September. Red snapper begin their spawning activities in the early afternoon and stop at dusk. Females are capable of producing 50 million eggs per year. Eggs and larvae could be exposed to CWIS entrainment for a total of six months. Red snapper have a high reproductive output and an extremely low entrainment rate.

Recreational Fisheries

With regard to recreational fisheries, the OOC industry-wide study assessed the most recreationally-important species (based on weight landed) in the GOM. According to the OOC industry-wide study, of the top ten recreational species taken in the GOM, seven species have shallow water distributions and would not be affected by the CWIS. The three remaining taxonomic groups are red snapper, dolphinfish (for which there is insufficient life-history information available), and other fish (for which no assessment was possible).

Forage Fishes

According to the OOC industry-wide study, anchovies are one of the most important forage fishes in the GOM. There are five species found in the GOM. The bay anchovy (*Anchoa mitchilli*), which is restricted to inshore waters, and the striped anchovy (*Anchoa hepsetus*) are the most common species. Anchovies spawn throughout the year with peak spawning from March to September. Adult anchovies are not candidates for entrainment in the CWIS because they tend to frequent brackish bays and inshore coastal waters. Eggs and larvae drift with prevailing currents and could be exposed to CWIS entrainment, but it is unlikely for this to occur because of the distance, prevailing currents, and the duration of the larval stage.

Assessment

For purposes of this assessment, yellowfin tuna was selected as a representative species that has commercial significance and is located in the deepwater continental shelf waters of the GOM as eggs, larvae, and adult. Red snapper was selected as a representative species that has commercial significance and may be located in the deepwater continental waters of the GOM as eggs and larvae only.

§I.B.12.a.2.i.(d) - Identification and evaluation of the primary period of reproduction, larval recruitment, and period of peak abundance for relevant taxa

The primary period of reproduction of the pelagic fishes whose eggs and larvae may be susceptible to entrainment in the CWIS varies, but the characterization for yellowfin tuna and red snapper indicates that spawning occurs in the warmer months of May through October. Many pelagic fishes are capable of dispersing eggs and larvae long distances from the release sites. The pelagic stage for yellowfin tuna eggs and larvae lasts for approximately 25 days. Juveniles are pelagic. The pelagic stage for red snapper eggs and larvae last approximately four weeks until the larvae develop and settle on the water bottom. Larval recruitment and development are typically associated with fine sand bottom away from reefs and ranging in depth of 20-180 meters.

§I.B.12.a.2.i.(e) - Data representative of the seasonal and daily activities (e.g., feeding and water column migration) of biological organisms in the vicinity of the cooling water intake structure

For purposes of this assessment, yellowfin tuna was selected as a representative species that has commercial significance and is located in the deepwater continental shelf waters of the GOM as eggs, larvae, and adult. Red snapper was selected as a representative species that has commercial significance and may be located in the deepwater continental waters of the GOM as eggs and larvae only.

Yellowfin tuna are highly migratory pelagic fishes that are found in the open waters of the GOM away from coastal areas. Yellowfin tuna make both seasonal and daily migrations. Each night, they can travel up to nine miles offshore to feed and return to the same area the next day. Yellowfin tuna typically remain in the surface and mixed water layer at night and dive to deeper waters during the day. Adults may be found in the vicinity of the CWIS, but are too large to be entrained in the CWIS. Eggs and larvae could be exposed to CWIS entrainment.

Red snapper live in areas with high relief (i.e., natural reefs, plaftorms) where these structures provide both food and protection from predators. Red snapper forage at night for shrimp, worms, and crabs that live in adjacent seabeds so that they do tend to migrate horizontally, but not vertically. Adults are not typically found in the deep waters of the continental shelf or close to the surface (in the vicinity of the CWIS). Eggs and larvae drift with the prevailing water currents and could be exposed to CWIS entrainment.

§I.B.12.a.2.i.(f) - Identification of all threatened, endangered, and other protected species that might be susceptible to impingement and entrainment at the cooling water intake structures

The only species of fish or shellfish listed as endangered in the GOM is the smalltooth sawfish (*Pristis pectinata*). Smalltooth sawfish are limited to inshore brackish waters. Embryonic development is ovoviviparous where eggs develop in the female and hatch immediately after extrusion from the female. Egg and larvae entrainment in the CWIS is not likely because of its distribution and reproductive strategy.

The only species of fish or shellfish listed as threatened in the GOM is the Gulf sturgeon (*Acipenser oxyrinchus desoti*). Gulf sturgeon are limited to major river systems and spawn in freshwater. Egg and larvae entrainment in the CWIS is not likely because of its distribution.

There are seven species of concern (fish) that may be found in the GOM. They include the speckled hind (*Ephinephelus drummondhayi*), Nassau grouper (*Ephinephelus striatus*), Warsaw grouper (*Ephinephelus nigritus*), dusky shark (*Carcharhinus obscurus*), largetooth sawfish (*Pristis pristis*), sand tigershark (*Carcharias taurus*), and the night shark (*Carcharhinus signatus*). Speckled hind and Warsaw are deepwater groupers with little information available on its life history. Eggs and larvae could potentially be impacted by entrainment by the CWIS. Nassau grouper occur between the shoreline and 90 meters. Adults are found on coral reefs and juveniles are found in seagrass beds. It is unlikely that eggs and larvae are susceptible to entrainment by the CWIS. The shark species are either ovoviviparous or viviparous (live birth); therefore entrainment is not likely because of its reproductive strategy.

Twenty-eight cetaceans (whales and dolphins) and one sirenian (manatee) species are present in the GOM. The northern right (*Eubalaena glacialis)*, blue (*Balaenoptera musculus)*, fin (*Balaenoptera physalus)*, sei (*Balaenoptera borealis)*, humpback (*Megaptera novaeangliae*), and the sperm whale (*Physeter macrocephalus)* are listed as endangered or threatened. The only member of the Order Sirenia found in the GOM is the endangered West Indian manatee (*Trichechus manatus manatus*). There are no critical habitats designated within the offshore GOM for the threatened and endangered species of mammals listed above.

Five species of sea turtles are found in the waters of the GOM. They include Kemp's ridley (*Lepidochelys kempii*), loggerhead (*Caretta caretta*), green (*Chelonia mydas*), leatherback (*Dermochelys coriacea*), and hawksbill (*Eretmochelys imbricata*). All are listed as endangered, except the loggerhead turtle, which is listed as threatened. Sea turtles spend nearly all of their lives in the water. Females must emerge periodically from the ocean to nest on beaches. Sea turtles are long-lived, slow-reproducing animals. It is generally believed that all sea turtle species spend the first few years of their lives in pelagic waters, occurring in driftlines and convergence zones (in Sargassum rafts) where they find refuge and food in items that accumulate in surface circulation features. No critical habitat has been designated for these species in the GOM. Marine mammals and sea turtles are not susceptible for entrainment because of their size and reproductive strategies (no planktonic eggs and larvae).

§I.B.12.a.2.i.(g) - If the information above is supplemented with data from field studies, the supplemental data must include a description of all methods and quality assurance procedures for sampling and analysis

Adequate references are provided for field studies or supplemental data that supports the information provided in this document.

Baseline Biological Summary and Conclusion

The location of the Big Foot TLP in the GOM will have minimal impacts on aquatic life due to the location of the CWIS and the engineering controls to be implemented to prevent entrainment in the CWIS. The CWIS is designed for an intake velocity of 0.24 feet per second (ft/s). The ZOI was calculated to be 0 ft. Therefore, it is very unlikely that pelagic fishes or their eggs and larvae would be entrained in the CWIS. Ambient water currents in the GOM are variable, but the velocity profile in the general area of the Big Foot TLP typically ranges from 0.00-0.82 ft/s. Therefore, water currents may exceed the intake velocity of the CWIS and offset the effect of CWIS entrainment.

Adult pelagic fishes will not be susceptible to entrainment in the CWIS because of the through-screen intake velocity and fixed screens. Of the few species that occupy and reproduce in the deeper waters of the continental slope in the GOM and for which there is sufficient life history data available, entrainment losses are estimated to be nominal. Most pelagic fishes inhabiting the GOM have pelagic eggs and larvae that can drift with the prevailing water currents and will be susceptible to entrainment in the CWIS. Also, adult pelagic invertebrates and free-swimming or drifting eggs and larvae from pelagic or benthic adults may be susceptible to entrainment in the CWIS. Egg and larvae densities are much lower in these deeper areas for species such as red snapper and anchovies.

For purposes of this assessment, yellowfin tuna was selected as a representative species that has commercial significance and is located in the deepwater continental shelf waters of the GOM as eggs, larvae, and adult. Red snapper was selected as a representative species that has commercial significance and may be located in the deepwater continental waters of the GOM as eggs and larvae only.

The OOC industry-wide study stated "*because of the low densities of fish eggs and larvae in these areas, and the relatively small volume of water used, the impacts predicted for the anticipated development scenario were predicted to be very small*" and "*the reproductive output of pelagic species such as the yellowfin tuna is dispersed over wide oceanic areas resulting in egg and larval densities that are quite low at any specific site.*"

§I.B.12.a.2.ii - Source Water Physical Data

§I.B.12.a.2.ii.(a) A narrative description and scaled drawings showing the physical configuration of all source water bodies used by your facility, including aerial dimensions, depths, salinities, and temperature regimes, and other documentation that supports your determination of the water body type where each cooling water intake structure is located

The GOM is the largest semi-enclosed coastal sea in the western Atlantic, encompassing about 579,150 mi^2 (1,500,000 km^2). The coastal areas contain more than 750 estuaries, bays, and sub-estuaries that are associated with 47 major estuaries. The GOM is divided into the continental shelf, continental slope and the GOM basin. The continental shelf varies in width extending as much as 155 mi (250 km) from the coastline in some areas, being narrowest in the vicinity of the Mississippi River Delta eastward to the Florida Panhandle. Water depth extends down to about 660 ft (200 m) on the continental shelf. The continental slope extends from the edge of the continental shelf to the start of the GOM Basin, with depths ranging from 660 to 9,800 ft (200 to 3,000 m). The GOM Basin contains the deepest waters and habitats. Water depths range from 9,800 ft (3,000 m) to more than 14,100 ft (4,300 m). Primary production in the GOM decreases with distance from the continental shelf.

Deep water areas in the northern GOM are relatively homogeneous with respect to temperature, and salinity. The average salinity in the GOM is 36 parts per thousand (ppt) although salinity may decrease to less than 25 ppt near freshwater input from rivers.

The surface temperature in the GOM is approximately 29° Celsius (C) (65° Fahrenheit (F)) while the winter temperature is approximately 19° C (66° F) in the northern GOM and 24° C (75° F) in the southern portion of the GOM. During the summer a thermocline may develop where warmer water may be found ranging in depth from just below the surface to 160 ft (50 m) below the surface. Below the thermocline the temperature of the water becomes colder and denser. The coldest water in the GOM is found below 3,300 ft (1,000 m) where the water is less than 4.4° C (40° F).

§I.B.12.a.2.ii.(b) - Identification and characterization of the source water body's hydrological and geomorphological features, as well as the methods you used to conduct any studies to determine your intake's area of influence within the water body and the results of such studies

The GOM is influenced by freshwater input from rivers (primarily the Mississippi River), which accounts for about two-thirds of the input into the GOM, and tropical storms (i.e., hurricanes), which represent a major climatological feature of the area. Much of the GOM consists of a soft, muddy bottom resulting from the influence of the Mississippi River and other rivers contributing to solids to the GOM.

Based on the calculations presented in Appendix B, the hydraulic zone of influence for the Big Foot TLP is 0.0 ft where the hydraulic zone of influence was defined to be locations where the water velocity will be greater than 0.25 ft/s (one-half of the maximum through-screen velocity) due to the CWIS operations. The calculations are based on the velocity through an imaginary plane located at various distances from the screen. The screens are designed to have a through-screen velocity equal to 0.24 ft/s under clean screen conditions.

§I.B.12.a.2.ii.(c) - Location Maps

A vicinity map is included as Figure 1 and an essential fish habitat map is included as Figure 2.

§I.B.12.a.2.iii - Cooling Water Intake Structure Data

The Big Foot TLP Design calls for a single Cooling Water Intake Structure (CWIS) to provide cooling water needs as shown on Figure 3. The CWIS will be located 112 ft below mean sea level. A total of three intake pumps will be used to withdraw cooling water from three associated caissons. Each of the cooling water pumps has a design intake capacity of 10.4 million gallons per day (MGD) [246,857 barrels per day (BPD)] for a Design Intake Flow (DIF) equal to 31.2 MGD (740,570 BPD) at production capacity. The operational plan for the Big Foot TLP calls for a maximum of two intake pumps to satisfy cooling water requirements at production capacity with the third intake pump to be used as a backup when any other pump either fails or requires routine maintenance. As such, the Actual Intake Flow (AIF) is not projected to exceed 20.8 MGD (493,714 BPD) at production capacity. The Big Foot TLP will operate 24 hours per day and 365 days per year.

Figure 4 contains the projected seawater balance diagram for the Big Foot TLP. In addition to the cooling water intake pumps, two jockey pumps, (each with a DIF equal to 0.4 MGD (10,286 BPD) provide a total DIF equal to 0.8 MGD (20,572 BPD)) are to be used. However, the jockey pumps are not used for cooling and have a separate intake from the cooling water intake pumps.

§I.B.12.a.2.iii.(a) - Design and construction technology plans and a description of operational measures which will be implemented to minimize impingement

The CWIS at the Big Foot TLP has been designed to have a clean-screen intake velocity of 0.24 ft/s. See Appendix A for detailed calculations that verify the 0.24 ft/s clean screen intake velocity requirement is met for the CWIS.

§I.B.12.a.2.iii.(a).(i) - A narrative description of the design, operation of the design, and construction technologies including fish handling and return systems that the facility will utilize to maximize the survival of species expected to be most susceptible to impingement. Provide species specific information that demonstrates the efficacy of the technology

The USEPA has defined a reduced intake velocity equal to 0.5 ft/s or less as a "best performing technology" in 76 FR 22203 and states that greater than 90% of all species can avoid impingement when intake velocities are below the 0.5 ft/s threshold. Similarly, the Track I requirements of 40 CFR 125.134 tacitly agree with best performing technology status of reduced intake velocity by requiring such reduced velocities for Track I compliance.

The Big Foot TLP CWIS are designed to have through-screen velocities equal to 0.24 ft/s under clean screen conditions at full production capacity (see Appendix A). Screens will undergo cleaning if the velocity approaches 0.5 ft/s. The fixed screens minimize impingement mortality by preventing organisms from experiencing high velocity intake water close to the intake caissons and limit the through screen velocity to a safe 0.5 ft/s or less during CWIS operation.

The source water baseline biological characterization indicates minimal potential for environmental impact associated with impingement at the Big Foot TLP due to design and construction technologies employed to ensure low intake velocities, small hydraulic zone of influence, and low occurrence of impingeable organisms in the area of the CWIS.

§I.B.12.a.2.iii.(a).(ii) - A narrative description of the design, operation of the design, and construction technologies that the permittee will utilize to minimize entrainment of those species expected to be most susceptible to entrainment

Based on the calculations presented in Appendix B, the hydraulic zone of influence for the Big Foot TLP is 0.0 ft where the hydraulic zone of influence is defined to be locations where the water velocity will be greater than 0.25 ft/s (one-half of the maximum through-screen velocity) due to the CWIS operations. The calculations are based on the velocity through an imaginary plane located at various distances from the screen. The screens are designed to have a through-screen velocity equal to 0.24 ft/s under clean screen conditions.

The ZOI would likely be further reduced with the inclusion of tidal current sweeping velocities. In order for potential IM&E impacts to occur, aquatic organisms would have to pass through the ZOI. Since the ZOI is a relatively small geographical reach when compared to the overall habitats available within the Gulf of Mexico, the opportunity for IM&E impacts is significantly diminished.

The source water baseline biological characterization presented in Section 2.3 of this document indicates minimal potential for environmental impact associated with entrainment at the Big Foot TLP due to design and construction technologies employed to ensure low intake velocities and small ZOI.

§I.B.12.a.2.iii.(a).(iii) - Design calculations, drawings, and estimates to support the descriptions above

C-K performed an analysis of the Big Foot TLP CWIS design to ensure that maximum through-screen velocities would be below the 0.5 ft/s threshold. A summary of study findings is presented in this section with the study analysis report itself included as Appendix A.

Cooling water will enter each CWIS through cut outs in the face of the CWIS with total cut-out areas of 167 ft^2. The cut outs will be covered by fixed screens with open areas of the screen comprising 80% of the gross screen area corresponding to an open screen area of 134 ft^2.

Only two intake pumps will be operating at any time with an AIF equal to 20.8 MGD. Based on the operational procedure, and on the information detailed above, the intake velocity for the CWIS is projected to be 0.24 ft/s under clean-screen conditions.

§I.B.12.a.2.iii.(b) - A narrative description of the configuration of each of the cooling water intake structures and the respective location in the water body and in the water column

Chevron proposes to construct and operate the Big Foot TLP in Block 29 of the Walker Ridge exploration area in the western Gulf of Mexico (GOM; Figure 1). The surface location for the Big Foot TLP will be approximately 149 miles (mi) (241 kilometers (km)) from Port Fourchon, which is also the nearest shoreline (Figure 1). The Big Foot TLP will be located in an area of the Gulf of Mexico with an average water depth of 6,936 ft (2,114 m).

The Big Foot TLP design calls for a single Cool Water Intake Structure (CWIS) to provide cooling water needs as shown on Figure 3. The CWIS will be located 112 ft below mean sea level. A total of three intake pumps will be used to withdraw cooling water from three associated caissons. Each of the cooling water pumps has a design intake capacity of 10.4 million gallons per day (MGD) for a Design Intake Flow (DIF) equal to 31.2 MGD at production capacity.

§I.B.12.a.2.iii.(c) - A narrative description of the operation of each of the CWIS, including design intake flows, daily hours of operation, number of days of the year in operation, and seasonal changes, if applicable

The Big Foot TLP will operate 24 hours per day and 365 days per year. The operational plan for the Big Foot TLP calls for a maximum of two intake pumps to satisfy cooling water requirements at production capacity with the third intake pump to be used as a backup when any other pump either fails or requires routine maintenance. As such, the Actual Intake Flow (AIF) is not projected to exceed 20.8 MGD at production capacity.

§I.B.12.a.2.iii.(d) - A flow distribution and water balance diagram that includes all sources of water to the facility, recirculating flows, and discharges

Figure 4 contains the projected seawater balance diagram for the Big Foot TLP.

§I.B.12.a.2.iii.(e) - Engineering drawings of the CWIS

An engineering drawing of the CWIS is included as Figure 3.

§I.B.12.a.2.iv - Velocity Information

§I.B.12.a.2.iv.(a) A narrative description of the design, structure, equipment, and operation used to meet the requirements of a maximum through screen intake velocity of 0.5 ft/s at each CWIS

The CWIS at the Big Foot TLP has been designed to have a maximum through-screen intake velocity, under clean-screen conditions, equal to 0.24 ft/s. Calculations verifying the through-screen velocity can be found in Appendix A.

§I.B.12.a.2.iv.(b) – Design calculations showing that the velocity requirement will be met at the minimum ambient source water surface elevation and maximum head loss across the screens or other devices

Cooling water will enter the CWIS through cut outs in the face of the CWIS with total cut-out areas of 167 ft. The cut outs will be covered by fixed screens with open areas of the screen comprising 80% of the gross screen area. The CWIS screens are located 112 ft below the water surface. The minimum surface water elevation results in 100% CWIS submergence.

I.B.12.b – COOLING WATER INTAKE STRUCTURE OPERATION REQUIRMENTS

I.B.12.b.1 – New Non-Fixed Facilities

The Big Foot TLP is a fixed facility. As such, the requirements of §I.B.12.b.1 do not apply.

I.B.12.b.2 – New Fixed Facilities that Do Not Employ Sea Chests

I.B.12.b.2.i – The cooling water intake structure must be designed and constructed so that the maximum through-screen velocity is 0.5 ft/s

The CWIS at the Big Foot TLP has been designed to have a maximum through-screen intake velocity, under clean-screen conditions, equal to 0.24 ft/s. Calculations that support this determination can be found in Appendix A. Cooling water will enter the CWIS through cut outs in the face of the CWIS with total cut-out areas of 167 ft. The cut outs will be covered by fixed screens with open areas of the screen comprising 80% of the gross screen area. Screens will be cleaned and/or replaced when visual monitoring shows that occlusion is approaching 50%, thus indicating that the through-screen velocity is approaching the 0.5 ft/s threshold.

I.B.12.b.2.ii – The operator must minimize impingement mortality of fish and shellfish and minimize entrainment of entrainable life stages of fish and shellfish through the use of cooling water intake design and construction technologies or operational procedures

The Big Foot TLP design incorporates fixed intake screens, low intake velocities, velocity monitoring, a small HZI, and a sufficient intake depth to minimize the likelihood of impingement.

Each CWIS is designed with sufficient open area to ensure that through-screen velocities remain below the 0.5 ft/s threshold; and to create a minimal HZI and associated environmental impact. The low through-screen velocity makes impingement an unlikely source of adverse environmental impact.

The low through-screen design velocity also results in protections against entrainment. The hydraulic zone of influence (HZI) has been defined in this document as the distance from the CWIS where species are subjected to intake velocities in excess of 0.25 ft/s; one half of the critical through-screen velocity. The theoretical basis for determining the HZI is presented in Appendix B. Pelagic species entering the HZI could be swept toward the CWIS and subsequently be impinged or entrained. The HZI for the Big Foot TLP is equal to 0.0 ft. indicating a low potential for IM&E.

I.B.12.b.3 – New Fixed Facilities that Employ Sea Chests

The Big Foot TLP is a new facility, but does not employ sea chests as cooling water intakes. As such, the requirements of §I.B.12.b.3 do not apply.

I.B.12.b.4 – For All Facilities

I.B.12.b.4.i – Routine biocide treatment of velocity or screen monitoring system is excluded from conditions established for chemically treated miscellaneous discharges provided biocides use is minimized to that needed for effectiveness and discharges are minimized. The type and amount of biocide and the date and time of application shall be recorded and made available for inspection.

Big Foot has no plans to use biocides to maintain through-screen velocities. If experience dictates that use of biocides are necessary, Big Foot will record the type and amount of biocide along with the dates and times of biocide application and will make such records available for inspection.

I.B.12.b.4.ii – Operators shall, to the extent practicable, schedule and perform maintenance of monitoring devices or screens so as to minimize increased IM&E due to maintenance activities

Big Foot will, to the extent practicable, schedule and perform maintenance of monitoring devices and screens such that increased IM&E is minimized. Big Foot will avoid maintenance during the primary period of production identified in the baseline study provided that maintenance is not required to prevent through-screen velocities from exceeding the 0.5 ft/s threshold.

I.B.12.c – MONITORING REQUIREMENTS

I.B.12.c.1 New Non-Fixed Facilities

The Big Foot TLP is a fixed facility. As such, the requirements of §I.B.12.c.1 do not apply.

I.B.12.c.2 – New Fixed Facilities that Do Not Employ Sea Chests

I.B.12.c.2.i – Visual or remote inspections. Beginning the coverage of this permit, the operator must conduct either visual inspections or use remote monitoring devices during the period the CWIS is in operation. The operator must conduct visual or remote monitoring monthly to ensure that the required design and construction technologies are maintained and operated so they continue to function as designed. Visual or remote monitoring is not required when conditions such as storms, high seas, evacuation, or other factors make it unduly hazardous to personnel, the facility, or the equipment utilized. The operator must provide an explanation for any such failure to visually or remotely monitor with the subsequent DMR submittal.

Big Foot will conduct monthly visual inspections and/or remote monitoring during CWIS operation to ensure that the design and construction technologies are functioning as designed. In the event that such monitoring is not possible due to hazardous factors beyond Big Foot's control, Big Foot will provide an explanation for the failure to provide the monitoring on its DMR submittal.

I.B.12.c.2.ii – Entrainment monitoring/sampling. After commencement of operations, the operator must monitor for entrainment. The operator must collect samples to monitor entrainment rates (simple enumeration) for each species over a 24-hour period and no less than biweekly during the primary period of reproduction, larval recruitment, and peak abundance identified during the Source Water Baseline Biological Characterization Study. Representative species may be utilized for this monitoring consistent with their use in the Source Water Baseline Characterization Study. The operator must collect samples only when permittee may reduce the monitoring frequency to once per quarter for the remainder of the permit. New facilities may join the currently on-going EPA approved industry-wide entrainment study.

Chevron is a member of the OOC and is a participant in the ongoing entrainment monitoring effort provided by the OOC. It is Chevron's understanding, based on the EPA response to comments regarding the issuance of the General Permit (Appendix D), that entrainment monitoring will be required quarterly pending the submittal and subsequent approval of the OOC 2-year entrainment monitoring study. In the event that this study is not complete, or is not approved by EPA prior to the Big Foot TLP service date, Big Foot will perform 24-hour biweekly monitoring during the primary period of larval recruitment and peak abundance identified in the Baseline Characterization. The representative species for which Big Foot intends to monitor include yellow fin tuna and red snapper.

Big Foot may use a Niskin Sampler to collect samples outside of the CWIS to obtain a representative sample of the water that passes through the intake pumps. EPA has used these samplers with great success in the Great Lakes and other locations for biological monitoring at specific depths. Alternatively, Big Foot may collect entrainment samples after the cooling water pump if the Niskin Samplers prove ineffective. Big Foot will use simple enumeration to report potentially entrained organisms.

Note that the representative species presented above are based on the OOC baseline characterization study. If the ongoing OOC entrainment study identifies different, more appropriate species, Big Foot will monitor for such species in addition to, or in lieu of, the species identified above, as appropriate.

I.B.12.c.2.iii – Velocity monitoring. The operator must monitor intake flow velocity across the intake screens to ensure the maximum intake flow velocity does not exceed 0.5 ft/s. The intake flow velocity shall be monitored daily. A downtime, up to two weeks, for periodic maintenance or repair is allowed and must be reported in the DMRs.

If occlusion appears to be due to growth on the CWIS screen, Big Foot will use monthly visual monitoring to estimate screen occlusion and combine these estimates with a linear occlusion model (presented in Appendix C) to monitor velocity across the intake screens. Although an exponential increase in percent occlusion is the most physically descriptive model of occlusion, the linear model has multiple benefits including:

- Conservative estimates of through-screen velocity. These conservative estimates serve to offset errors in the estimation of percent occlusion through visual monitoring;
- The ability to determine when the facility exceeds the maximum permissible velocity for DMR reporting purposes; and
- Ease and reproducibility of the calculations.

The Linear Occlusion Model will not be used if blockages to the CWIS screens appear to be due to debris in the water. Blockages due to trash or debris will be assumed to have occurred on the day of the inspection that identifies such blockages. These approaches may be modified or replaced if more appropriate alternative monitoring methods are developed.

I.B.12.d – REPORTING REQUIREMENTS

An annual status report of the required biological entrainment monitoring study must be provided to EPA for fixed facilities that do not employ sea chests. For all new facilities required to comply with intake structure monitoring requirements must submit the following information quarterly:

As a fixed facility that does not employ sea chests, Big Foot will submit an annual entrainment monitoring report in addition to the quarterly CWIS reporting required below.

I.B.12.d.1 – Visual or remote device inspection: Number of fish/shellfish impinged and estimated screen area blockage for each screen.

Big Foot will provide the number fish and/or shellfish impinged on each CWIS along with the estimated screen blockage for each screen. The monitoring and impingement assessments will be performed monthly and submitted quarterly as part of the DMR reporting process.

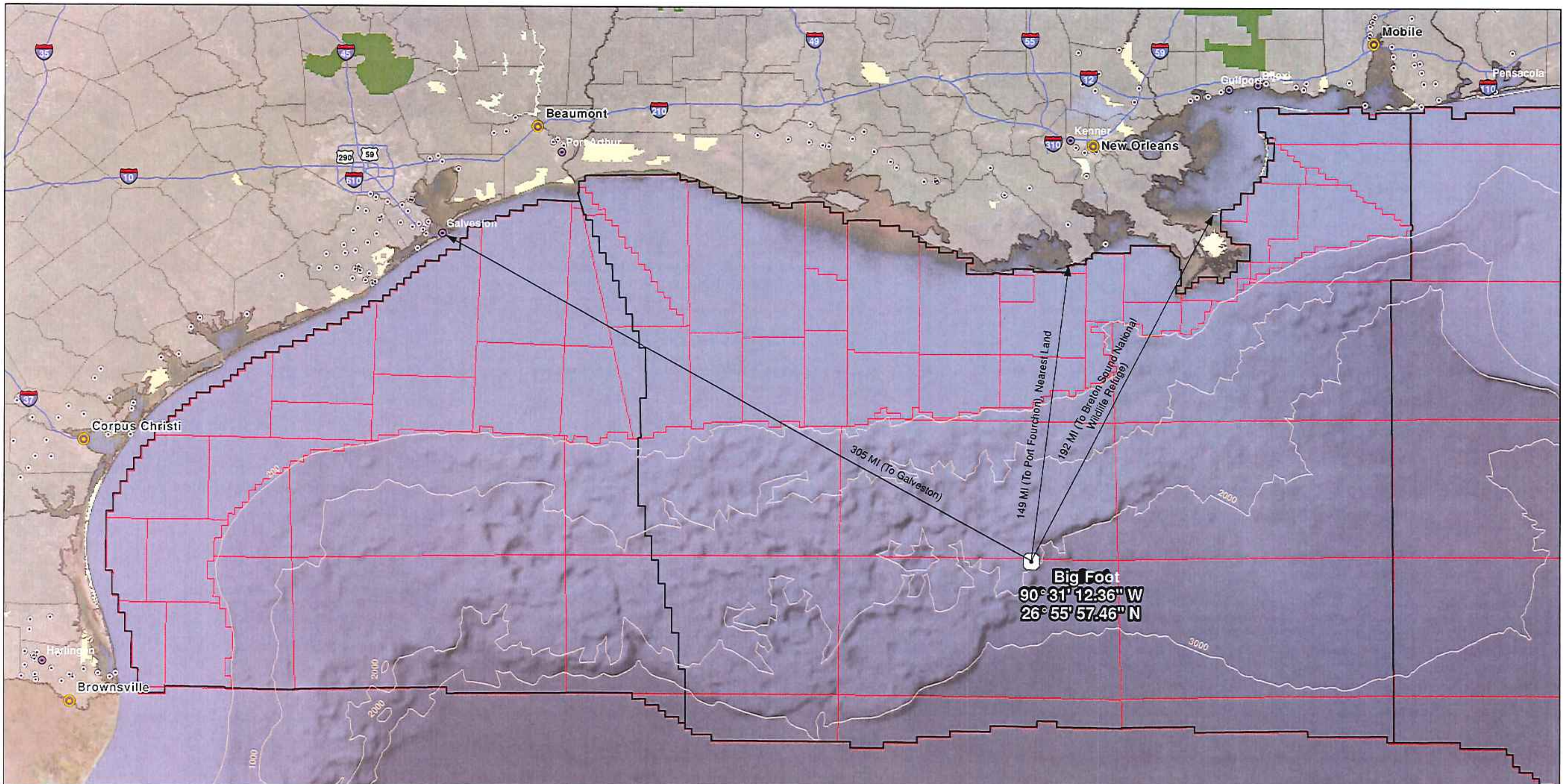
I.B.12.d.2 – Intake velocity monitoring: Number of days on which the maximum intake velocity is greater than 0.5 ft/s.

The following approach will be used until more appropriate alternative methods are developed for reporting. In the event that occlusion occurs due to growth on CWIS screens, Big Foot will combine the results of the monthly visual monitoring with a linear occlusion model to monitor velocity across the intake screens. Big Foot will use the model output to provide estimates of the number of days during which the maximum intake velocity exceeds 0.5 ft/s. However, if blockages appear to be due to debris within the water, the number of days reported will be based on the number of days since the blockage was identified.

FIGURES

FIGURE 1

VICINITY MAP



Coastal Cities (ESRI-POP2000)
- 0 - 50,000
- 50,001 - 100,000
- > 100.000

Bathymetric Contour in Meters (NOAA)
Planning Areas (MMS-GOMR)
Protraction Areas (MMS-GOMR)

Federal Lands (ESRI)
- Forest Service
- Fish and Wildlife Service
- National Park Service

0 20 40
Miles

Base Imagery: Esri Imagery World 2D.

Chevron

esri Partner Network

CHEVRON U.S.A. INC.
HOUSTON, TEXAS

316(b) APPLICATION ADDENDUM

VICINITY MAP

GULF OF MEXICO

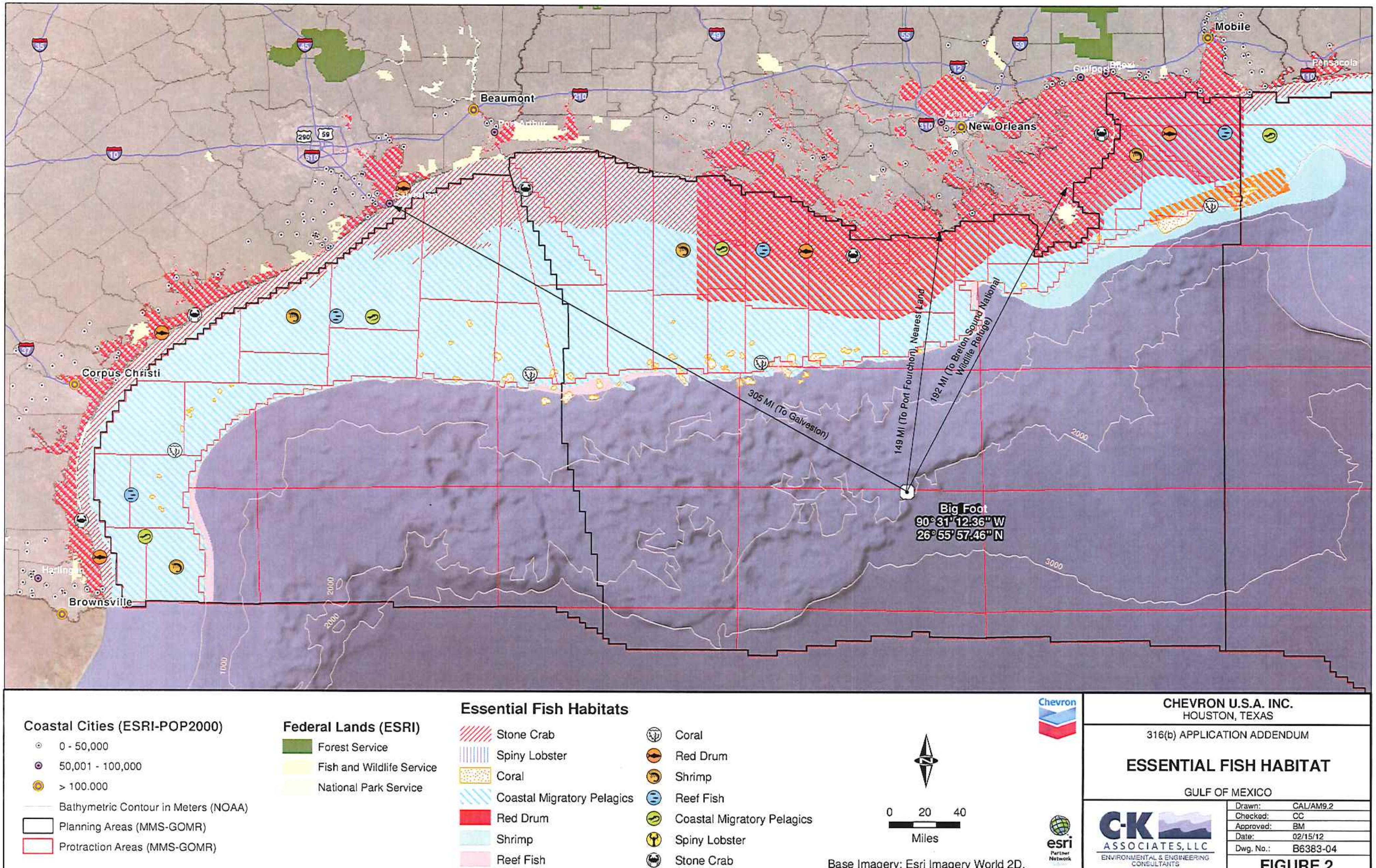
C-K ASSOCIATES, LLC
ENVIRONMENTAL & ENGINEERING CONSULTANTS

Drawn:	CAL/AM9.2
Checked:	CC
Approved:	BM
Date:	01/25/12
Dwg. No.:	B6383-03

FIGURE 1

FIGURE 2

ESSENTIAL FISH HABITAT



CHEVRON U.S.A. INC.
HOUSTON, TEXAS

316(b) APPLICATION ADDENDUM

ESSENTIAL FISH HABITAT

GULF OF MEXICO

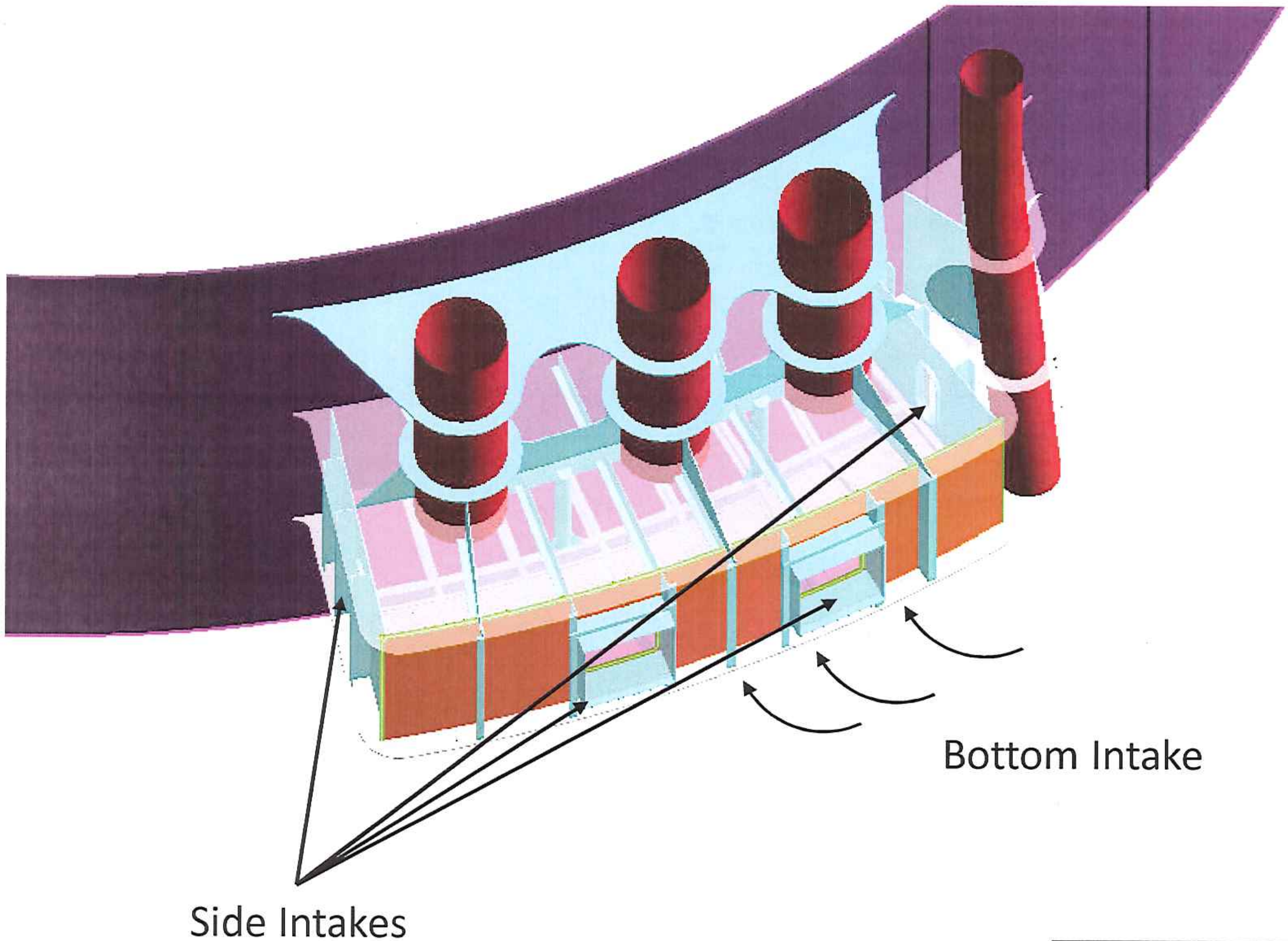
C-K ASSOCIATES, LLC
ENVIRONMENTAL & ENGINEERING CONSULTANTS

Drawn:	CAL/AM9.2
Checked:	CC
Approved:	BM
Date:	02/15/12
Dwg. No.:	B6383-04

FIGURE 2

FIGURE 3

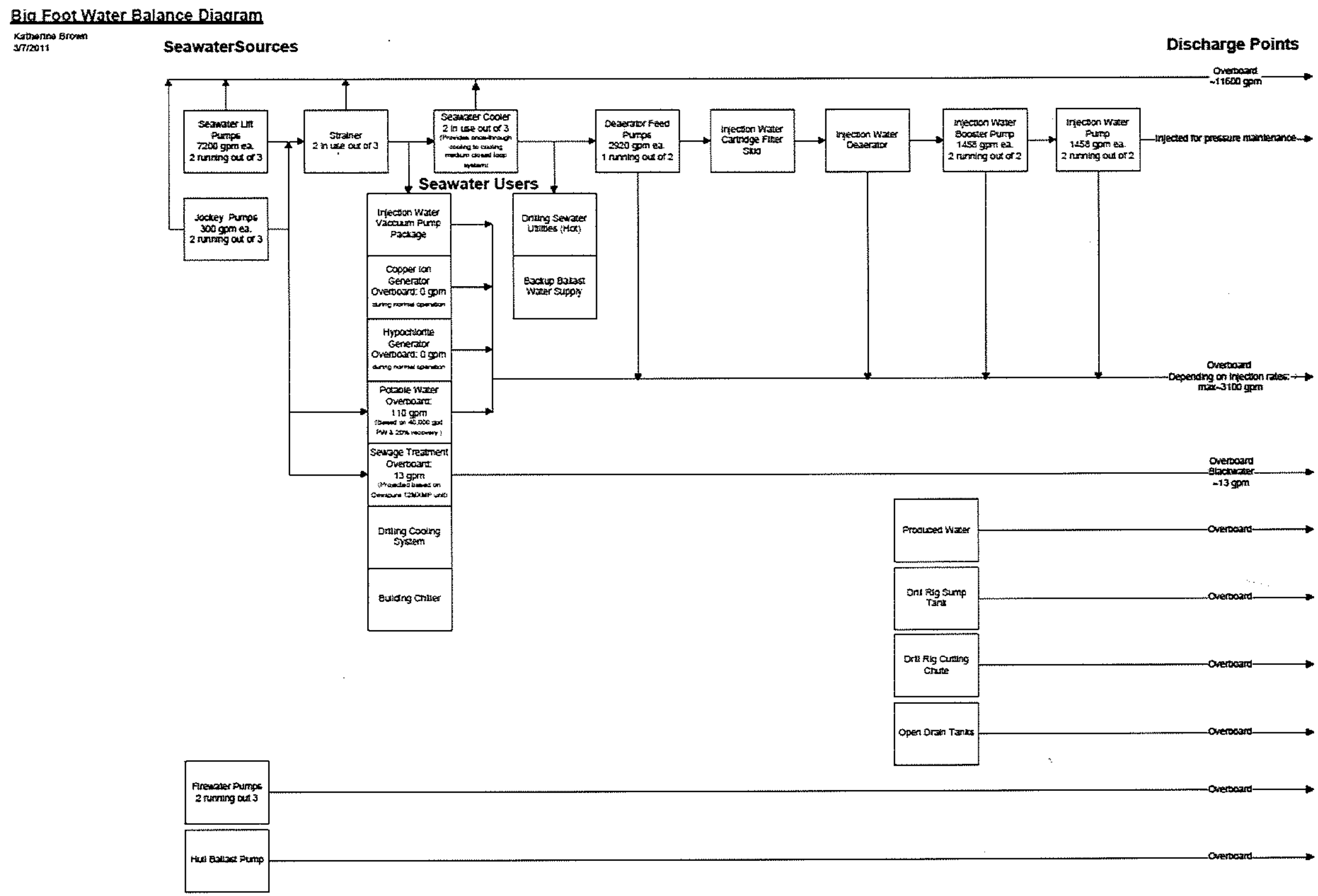
CWIS ENGINEERING DRAWING:
CHEVRON BIG FOOT TLP



CWIS Engineering Drawing Chevron Big Foot		
C-K Associates	Chevron U.S.A. Inc.	Figure 3

FIGURE 4

PROJECTED SEAWATER BALANCE:
CHEVRON BIG FOOT TLP



Projected Phase I Sea Water Balance
Chevron Big Foot

C-K Associates	Chevron U.S.A. Inc.	**Figure 4**

APPENDIX A

Cooling Water Intake Structure Through-Screen Intake Velocity Calculation Package Permit Number: GMG290132

Big Foot Tension Leg Platform

Chevron U.S.A. Inc.

Chevron North America Exploration

and Production Co.

100 Northpark Boulevard

Covington, Louisiana

March 2013

C-K Associates Project Number 6383-11

Prepared By:

C-K ASSOCIATES • LLC

17170 Perkins Road

Baton Rouge, LA 70810

(225) 755-1000

C-K Associates, LLC

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1.0 INTRODUCTION

The purpose of this report is to provide the mechanism by which the through-screen intake velocity was determined for the Cooling Water Intake Structure (CWIS) at the Chevron U.S.A. Inc. (Chevron) Big Foot Tension Leg Platform (TLP). The remainder of this report: i) provides background information related to the Big Foot TLP project; ii) provides a description of the Big Foot TLP'S's CWIS geometry; and iii) provides the methodology to demonstrate the through-screen velocity at the Big Foot TLP will be less than 0.5 feet per second (ft/s) when the Big Foot TLP is constructed.

2.0 BACKGROUND

Chevron proposes to construct and operate the Big Foot TLP in Block 29 of the Walker Ridge exploration area in the western Gulf of Mexico. Chevron proposes to construct a single CWIS to utilize and discharge once-through cooling water from the western Gulf of Mexico (Figure 1). The Big Foot TLP has a design intake flow of 31.1 million gallons per day (MGD) and a projected actual intake flow of 20.8 MGD where at least 25% of the total intake flow will be used as cooling water.

The USEPA has established regulations for new and existing offshore facilities under Section 316(b) of the Clean Water Act (CWA), which were promulgated on November 1, 2004. Section 316(b) provides that any standard established pursuant to Sections 301 or 306 of the CWA and applicable to a point source shall require that the location, design, construction, and capacity of the CWIS reflect the best available technology (BAT) for minimizing adverse environmental impact. This regulation applies to the intake of water and not to the discharge.

The primary potential impact of cooling water intake is the mortality or injury to fish or other aquatic organisms that may be impinged on screens or entrained into cooling systems where the organisms may be subject to thermal, physical, and chemical stresses. The USEPA has defined a reduced intake velocity equal to 0.5 feet per second (ft/s) or less as a "best performing technology" in Volume 76, Section 76 of the Federal Register (page 22203) and states that greater than 90% of all species can avoid impingement when intake velocities are below the 0.5 ft/s threshold. Similarly, the Track I requirements of Title 40 of the Code of Federal Regulations (CFR) §125.134 tacitly agree with best performing technology status of reduced intake velocity by requiring such reduced velocities for demonstrating Track I compliance.

3.0 CWIS DESCRIPTION

The Big Foot TLP CWIS provides cooling water to three intake pumps. Only two intake pumps will be operating at any time with the third pump kept in reserve. Cooling water will enter each CWIS through cut outs in the face of the CWIS with total cut-out areas of 167 square feet (ft^2). The cut outs will be covered by fixed screens with open areas of the screen comprising 80% of the gross screen area corresponding to an open screen area of 134 ft^2.

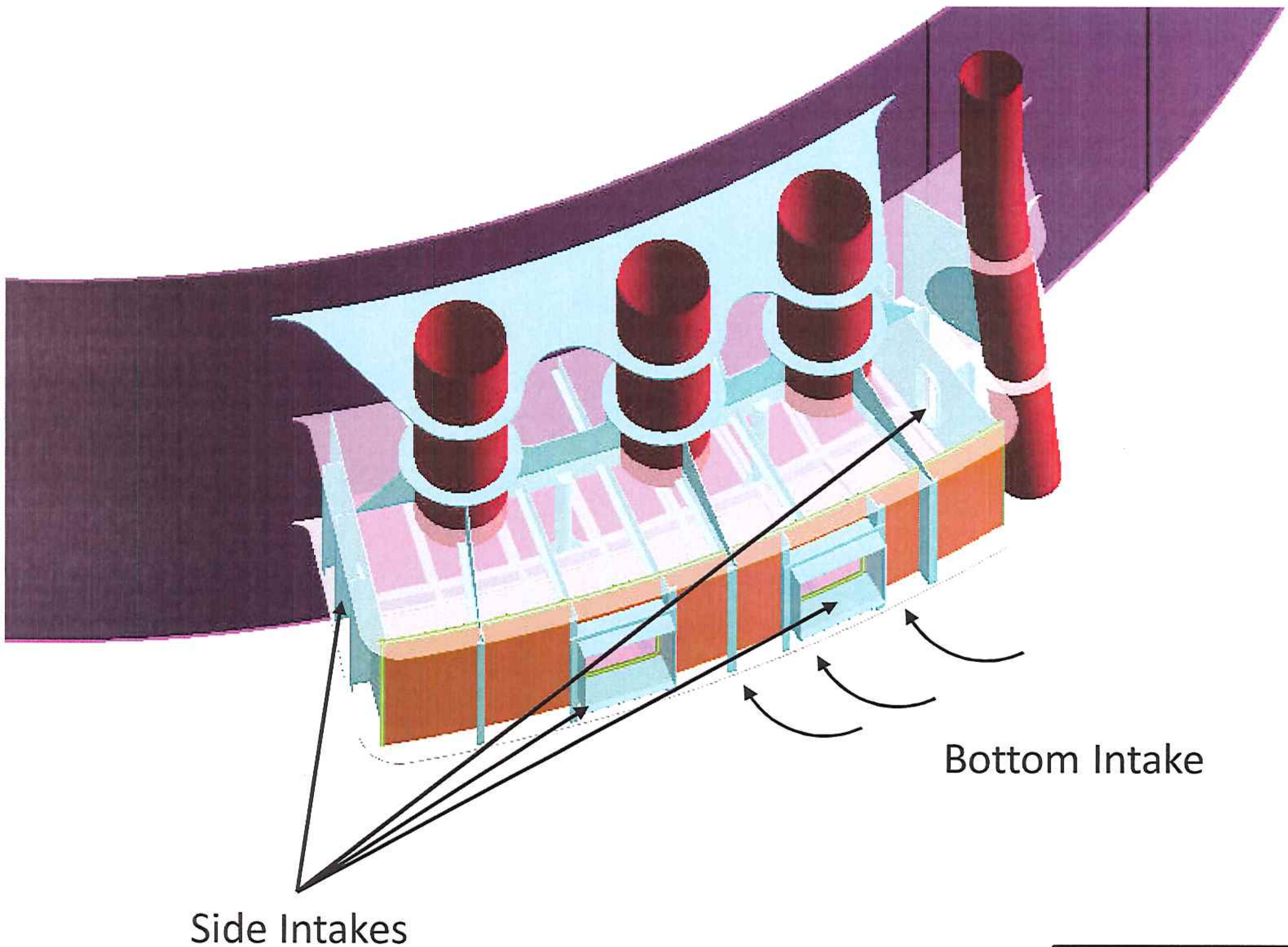
4.0 RESULTS

The through-screen intake velocity at the Big Foot TLP CWIS is projected to be 0.24 feet per second (ft/s) under clean-screen conditions (see Attachment 1). Over time, biofouling may occur on the intake screen thus reducing the open area available for flow. The reduced open area will cause increased intake velocity for a fixed volume of flow. Based on the analysis provided in Attachment 1, biofouling can occur to a maximum uniform thickness of 0.23 inches (slightly less than 1/4 inch) across all surfaces of the intake screens prior to the through-screen intake velocity exceeding the 0.5 ft/s threshold.

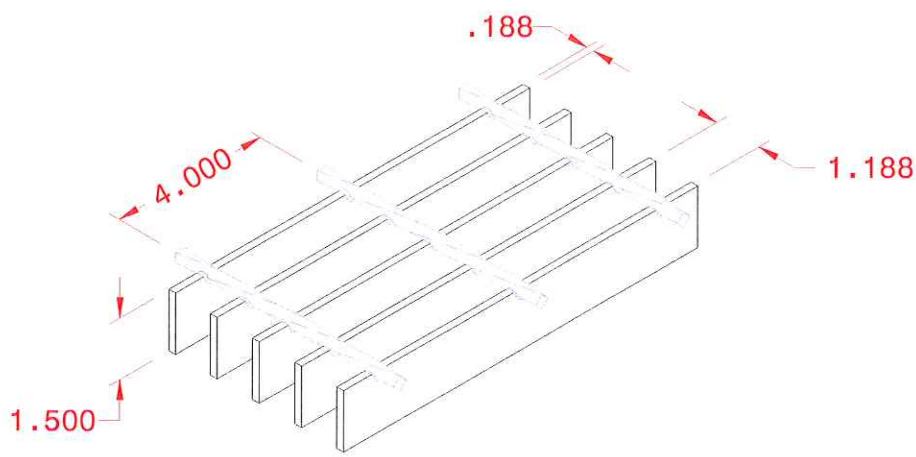
5.0 CONCLUSIONS

Based on the analysis presented in this document, the Big Foot TLP CWIS meets the requirements of a through-screen velocity not-to-exceed 0.5 ft/s as required by 40 CFR 125.134. The clean-screen velocity of 0.24 ft/s is more protective of impingeable species than is required by these regulations. The design of this CWIS is found to be consistent with the requirements of Track I compliance under Section 316(b) of the Clean Water Act.

FIGURES



CWIS Engineering Drawing Chevron Big Foot		
C-K Associates	Chevron U.S.A. Inc.	Figure 1



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3. Bearing Bar Centers: 1-3/16" Centers
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ATTACHMENT 1

THROUGH-SCREEN CALCULATION PACKAGE

Chevron Big Foot Intake Velocity Calculation Package
7 March 2012
Chad Cristina
C-K Associates

Objectives: 1) Determine the through-screen velocity of water entering the Big Foot cooling water intake structure (CWIS). 2) Determine maximum average fouling thickness prior to exceeding the critical through-screen velocity of 0.5 ft/s.

Description: The CWIS is covered by a steel screen to prevent large solids from entering the CWIS. A schematic of the screen is depicted below (not to scale; see Diagram 1).

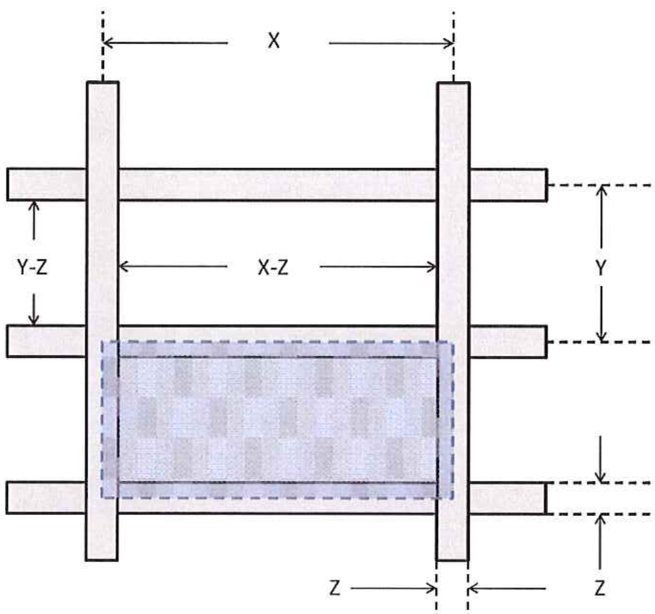

Diagram 1: Grating Diagram

Note: The shaded area in Diagram 1 represents a single cell of the CWIS screen. It is assumed that the screen is made up of multiple identical cells. The cell includes open area and area occluded by the screen material. The extents of the cell are the centerlines of the screen material along the horizontal and vertical directions.

Givens

$MGD := 10^6 \frac{gal}{day}$

$Q := 14400 \frac{gal}{min} = 20.736 \cdot MGD$

Design intake flow.

$X := 4in$

Distance between steel support bar centerlines along the long axis of the cell opening.

$Y := 1.188in$

Distance between steel support bar centerlines along the short axis of the cell opening.

$Z := 0.188in$

Thickness of steel bar used in screen.

$A_{bottomCWIS} := 20826in^2$

Total cross-sectional flow area along the bottom of the CWIS. Does not include blockage due to screen.

$A_{sidesCWIS} := 3236in^2$

Total cross-sectional flow area along sides of CWIS. Does not include blockage due to screen.

$A_{maxCWIS} := A_{bottomCWIS} + A_{sidesCWIS}$

$A_{maxCWIS} = 167.097 \cdot ft^2$

Total CWIS area open to the sea. A fraction of this area is occupied by the bars depicted in Diagram 1 and is not available as a flow path for water entering the CWIS.

$V_{crit} := 0.5 \frac{ft}{s}$

Maximum permissible through-screen velocity.

Step 1: Calculate the ratio of open area to maximum area for any given cell (assumes identical cells). Maximum area includes open area plus the area occupied by screen grating structure.

$A_{maxCELL} := X \cdot Y = 4.752 \cdot in^2$

Maximum available flow area for a given cell assuming that no flow area is occupied by the screen

$A_{openCELL} := (X - Z) \cdot (Y - Z) = 3.812 \cdot in^2$

Maximum available flow area for a given cell given that the screen blocks some fraction of flow path.

$R_{clean} := \frac{A_{openCELL}}{A_{maxCELL}} = 0.802 \cdot \frac{ft^2}{ft^2}$

Ratio of open area to maximum area for any cell within the CWIS screen.

Step 2: Calculate the intake velocity under a clean screen condition.

$$A_{cleanCWIS} := A_{maxCWIS} \cdot R_{clean} = 134.043 \cdot ft^2$$

Cross-sectional screen area available for intake water to pass under clean-screen conditions.

Note: Since the CWIS screen is composed of identical cells, the ratio of open area to maximum area for a cell is equal to the ratio of open area to maximum area for the entire CWIS.

$$V_{clean} := \frac{Q}{A_{cleanCWIS}} = 0.239 \cdot \frac{ft}{s}$$

Through-screen intake velocity under clean-screen conditions.

Note: Since the CWIS is composed of identical cells, the velocity through the CWIS is equivalent to the velocity through any cell.

Step 3: Calculate the maximum thickness d to which fouling can occur uniformly across the screen prior to exceeding the 0.5 ft/s threshold.

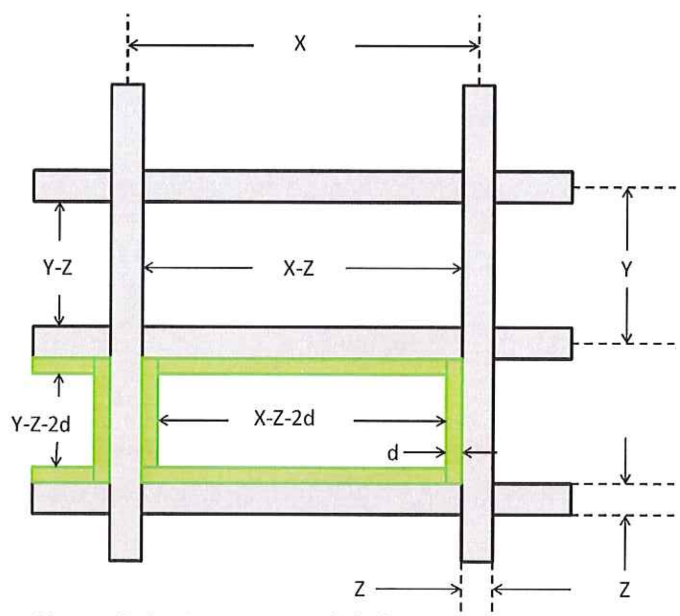

Diagram 2: Grating Diagram with fouling

Note: For the purposes of the following calculations, it is assumed that fouling occurs uniformly across all cells. Diagram 2 shows fouling in only two cells for demonstrative purposes.

$$A_{critCWIS} := \frac{Q}{V_{crit}} = 64.167 \cdot ft^2$$

Minimum flow area necessary to maintain through-screen velocity of 0.5 ft/s for the entire CWIS.

$$R_{crit} := \frac{A_{critCWIS}}{A_{maxCWIS}} = 0.384 \cdot \frac{ft^2}{ft^2}$$

Critical ratio of open area (including screen and fouling) to max area for the entire CWIS.

Note: R_{crit} applies to the CWIS in total, and to each individual cell under the assumption of uniform fouling across identical cells.

$$A_{foulCELL}(d) := (X - Z - 2d)(Y - Z - 2d)$$

The open area of a fouled cell as a function of the depth, d, of fouling on the cell surface.

$$R_{crit} = \frac{(X - Z - 2d_{critCELL}) \cdot (Y - Z - 2d_{critCELL})}{A_{maxCELL}}$$

Critical ratio of open area (including screen and fouling) to max area for any given cell.

Note: R_{crit} applies equally to the CWIS in its entirety and to individual cells. The controlling factor for R_{crit} at the cell level is the depth, d, of fouling on the screen surface shown in the equation for $A_{foulCELL}$. The value $d_{critCELL}$ is the maximum depth of fouling that can occur prior to R_{crit} and, by extension, V_{crit} being exceeded.

Solving for $d_{critCELL}$ results in a quadratic equation that may be solved using the binomial theorem or numerically as shown below.

$$f(d_{critCELL}) := \frac{(X - Z - 2d_{critCELL}) \cdot (Y - Z - 2d_{critCELL})}{A_{maxCELL}} - R_{crit}$$

To solve for $d_{critCELL}$ numerically, a new term $f(d_{critCELL})$ is created. The right-hand-side of $f(d_{critCELL})$ is equal to zero for two values of $d_{critCELL}$ (all binomial equations have two roots).

$$d_{critCELL} := \mathrm{root}\left(f\left(d_{critCELL}\right), d_{critCELL}, 0\,in, 1\,in\right) = 0.228 \cdot in$$

The root function guesses values of $d_{critCELL}$ until $f(d_{critCELL})$ is equal to zero. There are two values of $d_{critCELL}$ that satisfy the zero condition, but only one root has physical meaning; the root must be bound by 0 in (no fouling) and 1 in (complete fouling). Fouling thicker than 1 inch would result in zero open area for flow.

$$d_{critCELL} = 0.228 \cdot in$$

Solutions:

1. The proposed CWIS will have a through-screen velocity of 0.24 ft/s in the clean state.
2. The screen must undergo cleaning whenever the average thickness of biofouling exceeds 0.23 inches in depth to ensure that the through-screen velocity remains below the 0.5 ft/s threshold.

APPENDIX B

Cooling Water Intake Structure Hydraulic Zone of Influence Calculations Permit Number: GMG290132

Big Foot Tension Leg Platform

Chevron U.S.A. Inc.

Chevron North America Exploration and Production Co.

1500 Louisiana Street

Houston, TX 77002

March 2013

C-K Project Number 6383-11

Prepared By:

C-K ASSOCIATES • LLC

17170 Perkins Road

Baton Rouge, LA 70810

(225) 755-1000

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1.0 INTRODUCTION

This report summarizes the methodology used to determine the hydraulic zone of influence (HZI) for the Cooling Water Intake Structures (CWIS) at the proposed Chevron U.S.A. Inc. (Chevron) Big Foot Tension Leg Platform (TLP). The remainder of this report: i) provides background information related to the Big Foot TLP project; ii) provides a summary of projected CWIS intake velocities at the Big Foot TLP; iii) summarizes the calculation methodology used to estimate the HZI for the Big Foot TLP CWIS; and v) provides estimates of the HZI for the Big Foot CWIS for two operational schemes.

1.1 Background

Chevron proposes to construct and operate the Big Foot TLP in Block 29 of the Walker Ridge exploration area in the western Gulf of Mexico. Chevron proposes to construct a single CWIS to utilize and discharge once-through cooling water from the western Gulf of Mexico. The Big Foot TLP has a design intake flow of 31.2 million gallons per day (MGD) and a projected actual intake flow of 20.8 MGD where at least 25% of the total intake flow will be used as cooling water.

The USEPA has established regulations for new and existing offshore facilities under Section 316(b) of the Clean Water Act (CWA), which were promulgated on November 1, 2004. Section 316(b) provides that any standard established pursuant to Sections 301 or 306 of the CWA and applicable to a point source shall require that the location, design, construction, and capacity of the CWIS reflect the best available technology (BAT) for minimizing adverse environmental impact. This regulation applies to the intake of water and not to the discharge.

The primary potential impact of cooling water intake is the mortality or injury to fish or other aquatic organisms that may be impinged on screens or entrained into cooling systems where they may be subject to thermal, physical, and chemical stresses. The USEPA has defined a reduced intake velocity equal to 0.5 feet per second (ft/s) or less as a "best performing technology" in Volume 76, Section 76 of the Federal Register (page 22203) and states that greater than 90% of all species can avoid impingement when intake velocities are below the 0.5 ft/s threshold. Similarly, the Track I requirements of Title 40 of the Code of Federal Regulations (CFR) §125.134 tacitly agree with best performing technology status of reduced intake velocity by requiring such reduced velocities for Track I compliance.

1.2 Intake Velocity at the Big Foot TLP CWIS

The Big Foot TLP CWIS houses three intake pumps. Only two intake pumps will be operating at any time with the third pump kept in reserve. Cooling water will enter each CWIS through cut outs in the face of the CWIS with total cut-out areas of 167 square feet (ft^2). The cut outs will be covered by fixed screens with open areas of the screen comprising 80% of the gross screen area corresponding to an open screen area of 134 ft^2. The intake velocity is projected to be 0.24 feet per second (ft/s) under clean-screen conditions.

Over time, biofouling may occur on the intake screen thus reducing the open area available for flow. The reduced open area causes increased intake velocity for a fixed volume of flow. Based on the analysis provided in Attachment 1, biofouling can occur to a maximum uniform thickness of 0.23 inches across all surfaces of the intake screens prior to the through-screen intake velocity exceeding the 0.5 ft/s threshold.

2.0 HYDRAULIC ZONE OF INFLUENCE CALCULATIONS

2.1 Assumptions

In addition to the limitation on through-screen velocities, 40 CFR 125.134(b)(4)(i) and (ii) references the HZI for intake structures in terms of selecting and implementing technologies/measures to reduce impingement mortality, but provides no specific guidance regarding the method to calculate the HZI. The following assumptions were made to calculate the HZI for the Big Foot TLP:

- The HZI is defined as the volume bounded by the intake screen and an imaginary plane (flux plane) at some distance, r, from the CWIS screen at which the velocity through the flux plane is equal to one-half of the maximum allowable through-screen velocity (Figure 1); and
- The shape of the HZI is represented as a rectangular frustum with sides radiating at 45° angles from the horizontal and vertical axes of the CWIS perimeter.

The first assumption relies on the idea that 90% of all species can avoid impingement when intake velocities are below the 0.5 ft/s threshold. Therefore, greater than 90% of all species can avoid impingement at the flux plane at which the velocity is 0.25 ft/s. The second assumption assumes that cooling water flows to the CWIS within a theoretical geometric shape. This assumption is conservative because it ignores edge effects of water flowing outside of the frustum to the CWIS thus projecting the HZI to be slightly farther from the screen surface that it actually may be. This methodology does have the advantage of possessing a readily definable and calculable geometric shape and allows for independent verification of the HZI.

Figure 1 contains five graphics to describe the HZI. The side view shows the assumed flow path of water entering the rectangular frustum within a theoretical flow boundary that extends at a 45° angle from the vertical edge of the CWIS cut out. It is assumed that no water crosses this theoretical boundary thus providing a conservative estimate of the HZI. The top view shows the assumed flow path of water entering the rectangular frustum within a theoretical flow boundary that extends at a 45° angle from the horizontal along the edge of the CWIS cut out. It is also assumed that no water crosses this theoretical boundary.

2.2 Theoretical Flux Plane Determination

Figure 2 contains depictions of a rectangular CWIS and the methodology used to determine the flux plane area for the HZI calculations. The surface area at the edge of the screen is defined as:

$$A_s = LW \quad (1)$$

Where L = Length of the CWIS long axis (ft); and

W = Length of the CWIS short axis (ft)

Section A-A' shows that the length of the theoretical boundary long axis can be defined as the length of the CWIS long axis plus the additional distance (2zr) associated with the z:1 (H:V) slope associated with the theoretical flow boundary. Using section A-A', the length of the CWIS long axis can be defined as:

$$L_{FP} = L + 2zr \qquad \textbf{(2)}$$

Where L_{FP} = Length of the flux plane long axis (ft); and

z = Horizontal component of slope in the form z:1 (H:V) (dimensionless). Note that for a 45° angle, z = 1.

r = the distance of the flux plane from the screen measured normal to the screen surface (ft).

Similarly, the width of the flux plane can be defined as:

$$W_{FP} = W + 2zr \qquad \textbf{(3)}$$

Where W_{FP} = Length of the flux plane along the short axis (ft) and all other terms are as previously defined.

Using equations (2) and (3), and the assumption that z = 1, the area of the flux plane can be determined as:

$$A_{FP} = (L + 2r)(W + 2r) \qquad \textbf{(4)}$$

Where A_{FP} = The flux plane area (ft^2) and all other terms are as previously defined.

2.3 Hydraulic Zone of Influence Determination

The average velocity of water through any flux plane can be defined as:

$$V = \frac{Q}{A_{FP}} \qquad \textbf{(5)}$$

Where V = Velocity through the flux plane (ft/s); and

Q = Volumetric flow rate (ft^3/s)

The HZI can be defined as the distance r normal to the screen surface at which V = 0.25 ft/s. Consequently, the HZI can be defined implicitly as:

$$V = \frac{Q}{(L+2r)(W+2r)} = 0.25\frac{ft}{s} \qquad \textbf{(6)}$$

Equation (6) can be solved either numerically or with the binomial theorem to determine the HZI.

Input parameters for (6) can be found in Table 1.

3.0 RESULTS

Table 2 contains the results of the HZI calculations for the Big Foot CWIS. The HZI was determined to be 0.0 ft. The primary reason for this result is that the CWIS were designed to have a through-screen velocity of 0.24 ft/s under clean-screen conditions. Each CWIS cut out is covered by a screen with 80% open area. Once the plane of the screen is crossed, the cross-sectional area is immediately increased by 20% and increases geometrically as the normal distance between the flux plane and the screen increases.

Figure 3 shows the projected HZI as a function of critical velocity for operations at the Big Foot TLP. The critical velocity of 0.5 ft/s is protective of 90% of all species. The value upon which HZI calculations were performed (0.25 ft/s) is protective of greater than 90% of all species. The HZI remains 0 ft for all assumed values of critical velocity greater than 0.20 ft/s for the CWIS.

4.0 CONCLUSIONS

The HZI for the Big Foot TLP CWIS is 0.0 ft. This report provides the documentation for the delineation of the HZI required under 40 CFR 125.136(b)(3)(i)(B). The report furthermore demonstrates that the conservative CWIS design does not create or develop a through-screen velocity of 0.5 ft/s or more. As such, the CWIS design is protective of most species susceptible to impingement and/or entrainment.

TABLES

TABLE 1

INPUT PARAMETERS FOR HYDRAULIC ZONE OF INFLUENCE CALCULATION

Table 1
Input Parameters for Hydraulic Zone of Influence Calculation
Chevron U.S.A. Inc. Big Foot TLP

Parameter	Variable Name	Units	Value
Maximum Phase I Intake Flow[1]	Q	ft^3/s	27.9
CWIS Length	L	ft	14.8
CWIS Width	W	ft	9.8
CWIS Cut Out Area [1]	A	ft^2	145
Velocity at Edge of HZI	V	ft/s	0.25

(1) ZOI was calculated using the bottom intake screens. These screens represent 86.6% of the total screen area. It is assumed that flow is proportional to screen area. Therefore, 86.6% of the total flow was used in this analysis.

TABLE 2

HYDRAULIC ZONE OF INFLUENCE CALCULATION RESULTS

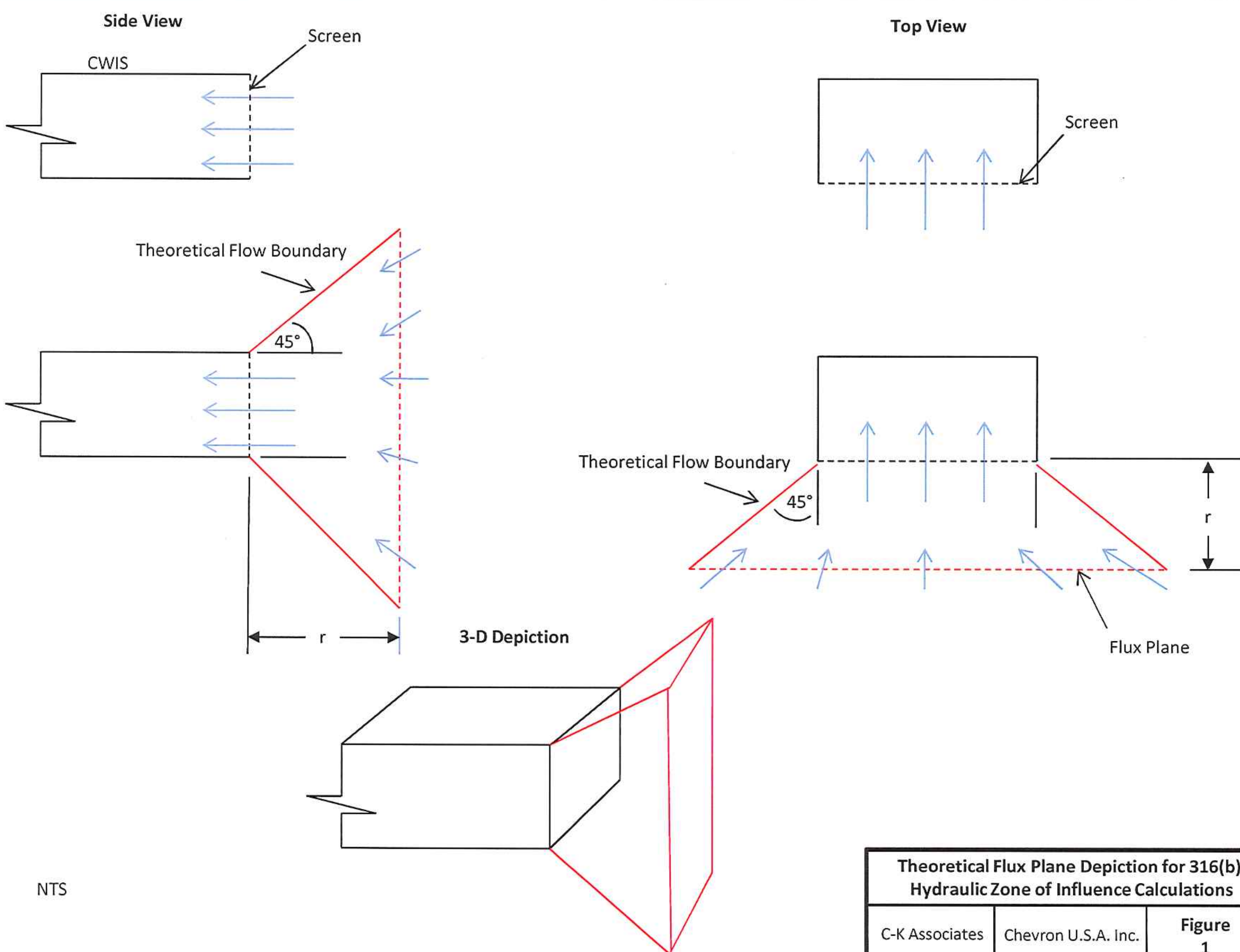
Table 2
Hydraulic Zone of Influence Calculation Results
Chevron U.S.A. Big Foot TLP

Parameter	Variable Name	Units	Value
Area of Flux Plane at the HZI	A_{FP}	ft^2	145
Distance to HZI	r	ft	0.0

FIGURES

FIGURE 1

THEORETICAL FLUX PLANE DEPICTION FOR 316(b) HYDRAULIC ZONE OF INFLUENCE CALCULATIONS

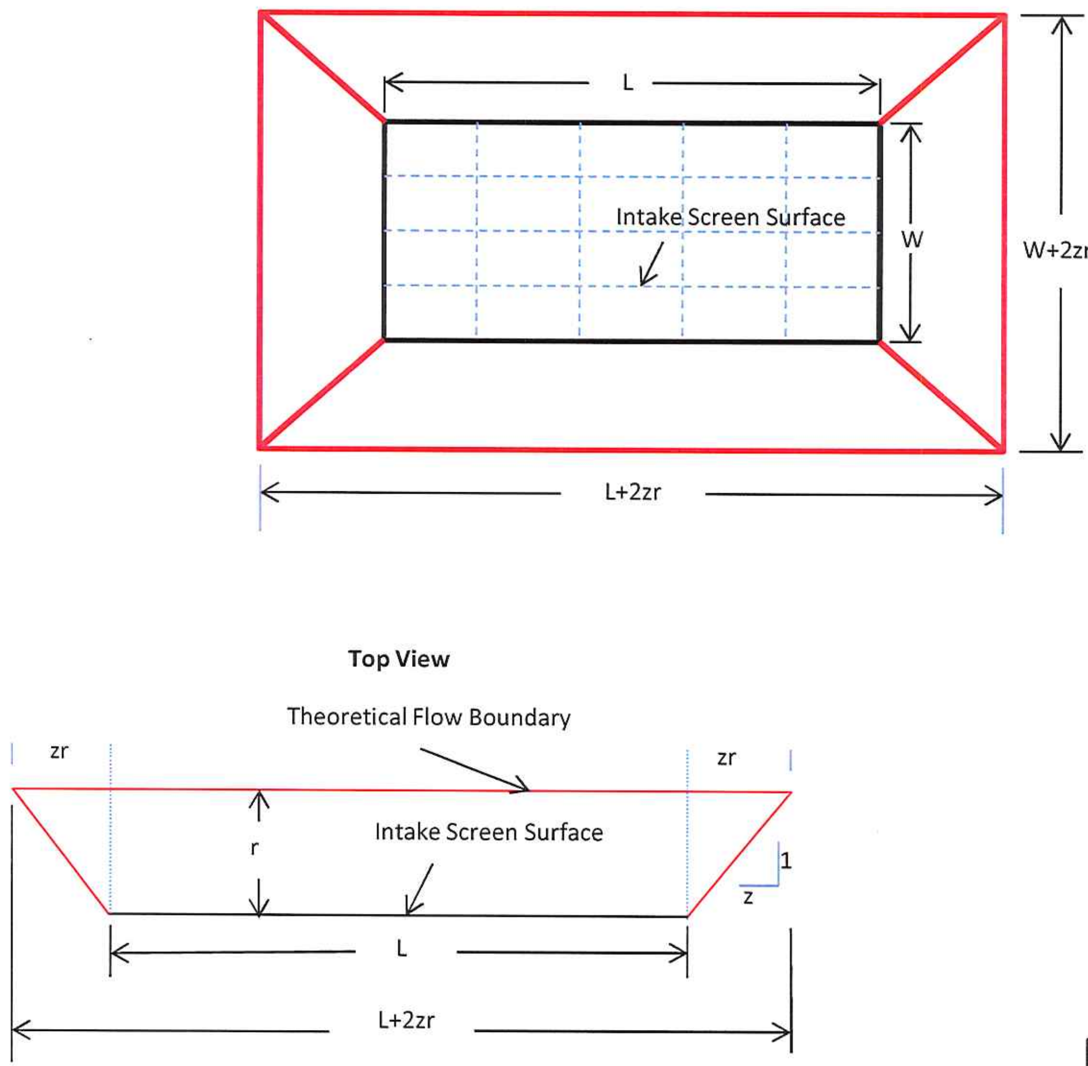


Theoretical Flux Plane Depiction for 316(b) Hydraulic Zone of Influence Calculations		
C-K Associates	Chevron U.S.A. Inc.	Figure 1

FIGURE 2

THEORETICAL FLUX PLANE DETERMINATION FOR 316(b) HYDRAULIC ZONE OF INFLUENCE CALCULATIONS

Front View



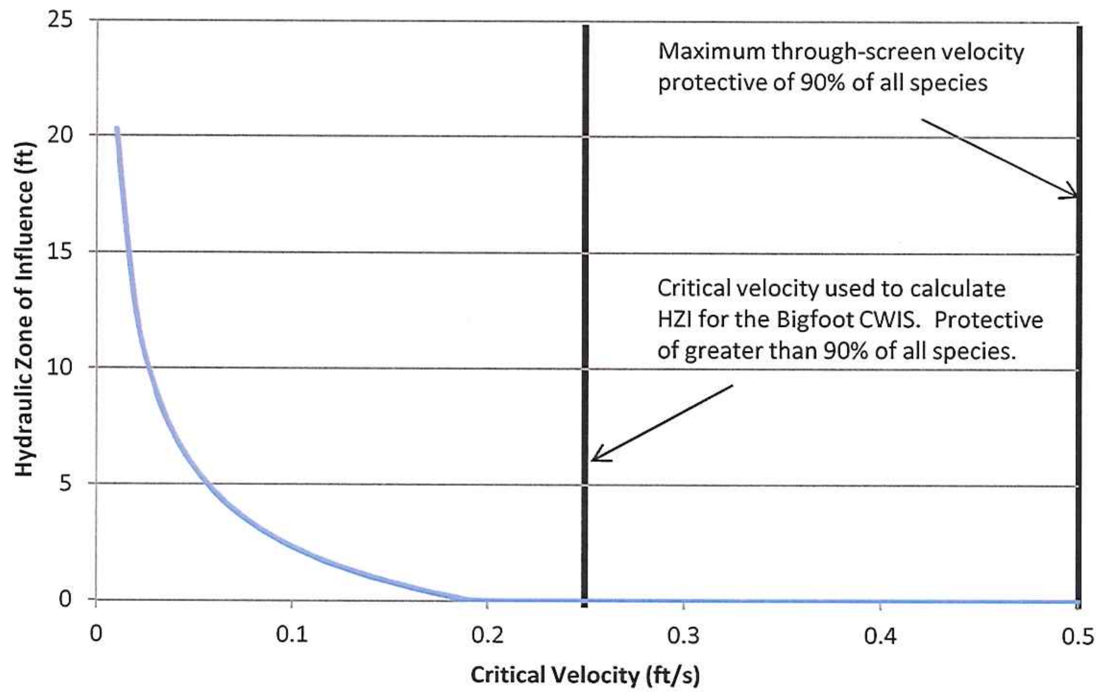
Note: For a 45° angle, z = 1

NTS

Theoretical Flux Plane Dimension Determination for 316(b) Hydraulic Zone of Influence Calculations		
C-K Associates	Chevron U.S.A. Inc.	Figure 2

FIGURE 3

HYDRUALIC ZONE OF INFLUENCE CALCULATION RESULTS FOR BIG FOOT CWIS



Hydraulic Zone of Influence Calculation Results for Big Foot CWIS		
C-K Associates	Chevron U.S.A. Inc.	Figure 3

APPENDIX C

Cooling Water Intake Structure Through-Screen Intake Velocity Monitoring Methodology Permit Number: GMG290132

Big Foot Tension Leg Platform

Chevron U.S.A. Inc.

100 Northpark Boulevard

Covington, Louisiana

March 2013

Prepared By:

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1.0 INTRODUCTION

This report summarizes the proposed methodology to monitor the through-screen intake velocity for the Cooling Water Intake Structures (CWIS) at the proposed Chevron U.S.A. Inc. (Chevron) Big Foot Tension Leg Platform (TLP). The information provided herein includes: i) background information related to the Big Foot project; ii) a summary of CWIS intake velocities at the Big Foot TLP; and iii) the methodology by which Big Foot will monitor CWIS through-screen intake velocity.

1.1 Background

Chevron proposes to construct and operate the Big Foot TLP in Block 29 of the Walker Ridge exploration area in the western Gulf of Mexico. The surface location for the Big Foot TLP will be approximately 150 miles (mi) (241 kilometers (km)) from the nearest shoreline and 150 mi (241 km) from Port Fourchon, Louisiana. The Big Foot TLP will be located in an area of the Gulf of Mexico with an average water depth of 6,936 feet (ft) (2,114 meters (m)).

The Big Foot TLP design calls for a single Cooling Water Intake Structure (CWIS) to provide cooling water for the Big Foot TLP. The CWIS will be located 112 feet below mean sea level. A total of three intake pumps will be used to withdraw cooling water from three associated intake caissons. Each of the cooling water pumps has a design intake capacity of 10.4 million gallons per day (MGD) [246,857 barrels per day (BPD)] for a Design Intake Flow (DIF) equal to 31.2 MGD (740,570 BPD). The operational plan for the Big Foot TLP calls for a maximum of two intake pumps to satisfy cooling water requirements with the third intake pump to be held in reserve in the event that any other pump either fails or requires routine maintenance. As such, the Actual Intake Flow (AIF) is not projected to exceed 20.8 MGD (493,714 BPD) at production capacity. The Big Foot TLP will operate 24 hours per day and 365 days per year.

The United States Environmental Protection Agency (USEPA) has established regulations for new and existing offshore facilities under Section 316(b) of the Clean Water Act (CWA), which were promulgated on November 1, 2004. Section 316(b) provides that any standard established pursuant to Sections 301 or 306 of the CWA and applicable to a point source shall require that the location, design, construction, and capacity of the CWIS reflect the best available technology (BAT) for minimizing adverse environmental impact. This regulation applies to the intake of water and not to the discharge.

The primary impact of cooling water intake is the mortality or injury to fish or other aquatic organisms that may be impinged on screens or entrained into cooling systems where they may be subject to thermal, physical, and chemical stresses. The USEPA has defined a reduced intake velocity equal to 0.5 feet per second (ft/s) or less as a "best performing technology" in Volume 76, Section 76 of the Federal Register (page 22203) and states that greater than 90% of all species can avoid impingement when intake velocities are below the 0.5 ft/s threshold. Similarly, the Track I requirements of Title 40 of the Code of Federal Regulations (CFR) §125.134 tacitly agree with best performing technology status of reduced intake velocity by requiring such reduced velocities for Track I compliance.

To ensure that intake velocities are maintained at or below the 0.5 ft/s threshold, 40 CFR 125.139(b) and Section I.B.12.c.2.iii of the *NPDES General Permit for New and Existing Sources and New Dischargers in the Offshore Subcategory of the Oil and Gas Extraction Category for the Western Portion of the Outer Continental Shelf of the Gulf of Mexico* (general permit) require new offshore oil and gas platforms to monitor intake flow velocity across the intake screens to ensure the maximum intake flow velocity does not exceed 0.5 ft/s. The general permit requires velocity monitoring on a daily basis.

1.2 Intake Velocity at the Big Foot TLP CWIS

Chevron proposes to operate a total of three intake pumps to collect cooling water for the Big Foot TLP. Only two intake pumps will be operating at any time with the third pump kept in reserve. Cooling water will enter the CWIS through cut outs in the face of the CWIS with total cut-out areas of 167 square feet (ft^2). The cut outs will be covered by fixed screens with open areas of the screen comprising 80% of the gross screen area corresponding to an open screen area of 134 ft^2. The intake velocity is projected to be 0.24 feet per second (ft/s) under clean-screen conditions. The low clean-screen velocity allows for biofouling occurring to a uniform depth of 0.23 inches on all screen surfaces prior to intake velocities exceeding the 0.5 ft/s limit.

2.0 VELOCITY MONITORING BASIS

Big Foot proposes to use a through-screen velocity monitoring program that is based on an estimate of percent screen occlusion developed from visual monitoring of the CWIS. The following assumptions have been used to determine the daily through-screen velocity based on percent screen occlusion.

2.1 Assumption 1: The Through-Screen Velocity of the Clean-Screen Condition is Known

An engineering analysis of the proposed CWIS has indicated that the clean-screen design intake velocity is equal to 0.24 ft/s (Appendix A).

2.2 Assumption 2: A Mechanism Exists to Estimate Screen Occlusion

Big Foot will use the monthly visual monitoring to estimate screen occlusion.

2.3 Assumption 3: Daily Screen Occlusion can be Conservatively Modeled

The Big Foot TLP is located approximately 150 miles from the nearest land in deep water. As such, the intake screens are not subject to the rapid occlusion that can occur in nearshore and onshore applications due to leaf and branch impingement. Occlusion in the offshore intake screens will be dominated by the growth of organic matter, such as barnacles, on the screens provided that impingement is limited through limiting the maximum through-screen velocity to 0.5 ft/s.

Organic growth on these screens is limited by surface area. As organic matter grows on the screens, the organic matter itself provides additional surface area on which other organic matter can attach. In theory, the organic attachment process, and hence screen occlusion, occurs in a non-linear manner if viewed over long time spans. However, if viewed over short time spans, the assumption of linear growth overestimates percent screen occlusion and hence daily through-screen velocity.

The exponential form of the occlusion model can be expressed as:

$$\frac{dO}{dt} = kO \tag{1}$$

Where O represents percent occlusion (%); k is an empirical constant (1/day); and dO/dt is the derivative representing the change in occlusion as a function of time (%/day). Note that k must be greater than or equal to 0 1/day for occlusion to increase over time. Equation 1 states that the change in occlusion at any time is proportional to the amount of occlusion that is present. Integrating equation 1 yields:

$$O = O_0 e^{kt} \tag{2}$$

Where O_0 is the initial screen occlusion and e is the exponential function.

The linear form of the occlusion model can be expressed as:

$$\frac{dO}{dt} = c \tag{3}$$

Where c is an empirical constant (%/day). Note that c must be greater than zero for occlusion to increase over time. Equation 3 states that the rate of change in occlusion is constant over time. Integrating equation 3 yields:

$$O = ct \tag{4}$$

Figure 1 shows an example of the exponential occlusion model from Equation 2 where O_0 = 1%, and k = 1.416 1/day. Note that the occlusion pattern shown on Figure 1 is explanatory in nature and does not represent actual occlusion data. The figure shows an accelerating change in occlusion as a function of time. For instance, occlusion increases by 3% between months 0 and 1; by 13% between months 1 and 2; and 53% between months 2 and 3.

Figure 2 contains the same exponential occlusion model along with linear approximations of the exponential model for each time interval. The interval from 0 to 1 month shows that the linear model (red line) slightly overestimates the "true" exponential occlusion. The same observation holds for the remaining two intervals (months 1 – 2 and months 2 – 3). It can be shown mathematically that the linear approximation will be greater than or equal to the exponential value any time c is greater than zero and k is greater than or equal to zero. These two constants must fall into these restricted ranges for any occlusion model. Therefore the linear approximation will always provide an estimate of occlusion that is greater than or equal to that provided by the exponential model.

2.4 Assumption 4: Permit Compliance can be Determined with a Linear Occlusion Model

The intent behind velocity monitoring is twofold. Most importantly, a facility must be able to demonstrate that the through-screen velocity is less than the maximum allowable velocity of 0.5 ft/s. The actual velocity has relatively little import provided that the maximum permissible velocity is not exceeded. The secondary purpose of velocity monitoring is to determine the number of days a facility was out of compliance for purposes of permit compliance reporting on the facility's discharge monitoring report. The linear occlusion model accomplishes each of these goals in a conservative manner.

Linear regression between months 2 and 3 yields the following equation to estimate percent occlusion for month 3:

$$O = 1.767t + 17 \quad \textbf{(5)}$$

The general equation to determine the daily velocity based on percent screen occlusion is:

$$v = \frac{Q}{A_{clean} * (1 - O/100)} \quad \textbf{(6)}$$

Where v is the through screen velocity (ft/s); Q is the measured intake flow (ft^3/s); and O is the percent occlusion. Note that O is divided by 100 to convert from percent to a fraction.

Based on Equation 5, the percent occlusion on the first day of month 3 (day 0) is 17%. Assuming a total intake flow of 32 ft^3/s (full production capacity CWIS) and given that A_{clean} = 134 ft^2 for the CWIS, the velocity on the first day of month 3 is estimated to be:

$$v = \frac{32\frac{ft^3}{s}}{134ft^2 * (1 - 17/100)} = 0.29\frac{ft}{s} \quad \textbf{(7)}$$

The calculation for each day of the month is presented in Table 1 along with the estimates of through-screen velocity using the exponential model. The use of the linear model indicates that the facility was out of compliance for 10 days in month 3. Assuming that the exponential model represents the "true" occlusion, the facility was out of compliance for 6 days. The linear model provides a reasonable estimate of the daily intake velocity and a conservative estimate of the days that the facility was out of compliance.

3.0 SUMMARY AND DISCUSSION

Big Foot plans to use monthly visual monitoring of each CWIS in conjunction with a linear model of percent occlusion to calculate the daily through-screen velocity of its CWIS. Although an exponential increase in percent occlusion is the most physically descriptive model of occlusion, the linear model has multiple benefits including:

- Conservative estimates of through-screen velocity. These conservative estimates serve to offset errors in the estimation of percent occlusion through visual monitoring;
- The ability to determine when the facility exceeds the maximum permissible velocity for DMR reporting purposes; and
- Ease and reproducibility of the calculations.

TABLE 1

Example calculations for Month 3 data (presented in Figure 1) of daily through-screen velocity using a linear model of percent screen occlusion

Day	Linear Model Percent Occlusion (%)	Exponential Model Percent Occlusion (%)	Linear Model Through-Screen Velocity (ft/s)	Exponential Model Through Screen Velocity (ft/s)
0	17	17	0.29	0.29
1	19	18	0.29	0.29
2	21	19	0.30	0.29
3	22	20	0.31	0.30
4	24	21	0.31	0.30
5	26	21	0.32	0.30
6	28	23	0.33	0.31
7	29	24	0.34	0.31
8	31	25	0.35	0.32
9	33	26	0.36	0.32
10	35	27	0.37	0.33
11	36	29	0.37	0.33
12	38	30	0.39	0.34
13	40	31	0.40	0.35
14	42	33	0.41	0.36
15	44	34	0.43	0.36
16	45	36	0.43	0.37
17	47	38	0.45	0.38
18	49	40	0.47	0.40
19	51	42	0.49	0.41
20	52	44	0.50	0.42
21	54	46	0.52	0.44
22	56	48	0.54	0.46
23	58	50	0.57	0.48
24	59	53	0.58	0.50
25	61	55	0.61	0.53
26	63	58	0.65	0.57
27	65	61	0.68	0.61
28	66	64	0.70	0.66
29	68	67	0.75	0.72
30	70	70	0.80	0.80

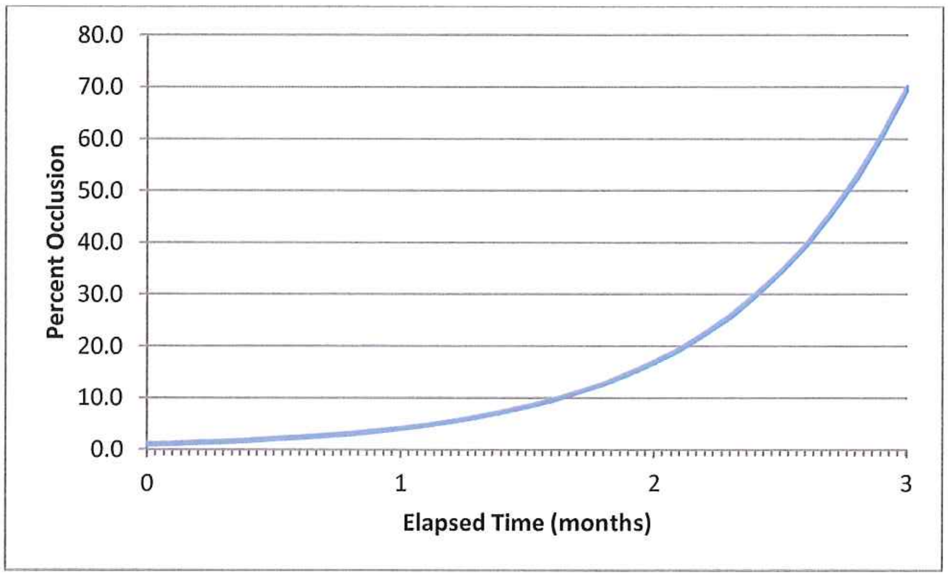
Notes Yellow shaded cells indicate days in excess of the maximum permissible through-screen velocity.

Example calculations are explanatory and do not represent actual measurements.

FIGURES

FIGURE 1

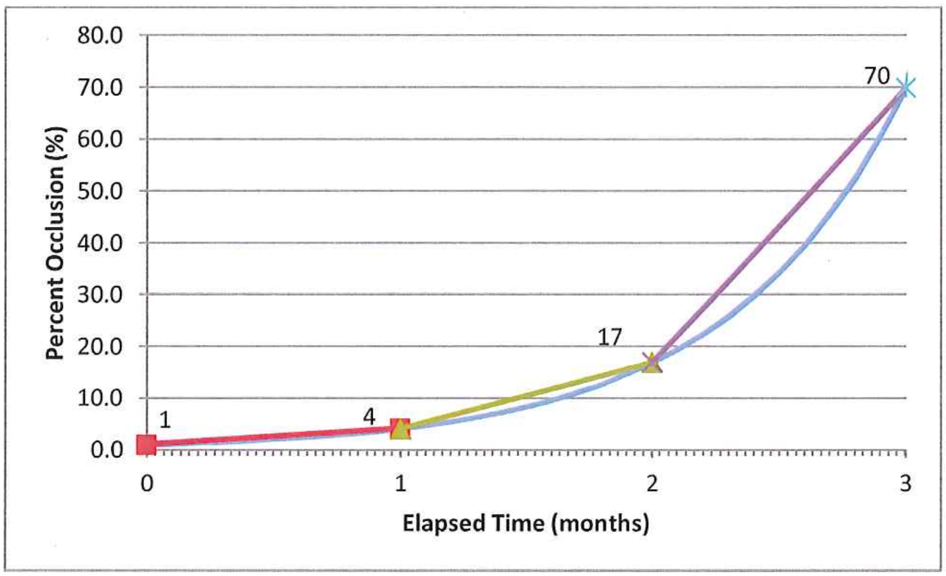
Example CWIS intake screen occlusion as an exponential function of time. Assumes that the increase in occlusion is an exponential function of the form $y = y_o e^{kt}$



The specific form of the exponential equation shown on Figure 1 is $y = 1e^{1.416t}$

FIGURE 2

Example CWIS intake screen occlusion as an exponential function of time and as linear approximations of the exponential function.



APPENDIX D

Final NPDES General Permit for Discharges from New and Existing Sources in the Offshore Subcategory of the Oil and Gas Extraction Point Source Category for the Western Portion of the Outer Continental Shelf of the Gulf of Mexico (GMG290000)

Agency: United States Environmental Protection Agency

Action: Final permit decision and response to comments received on the draft reissued NPDES permit publicly noticed in the Federal Register on March 7, 2012.

Date: September 28, 2012

Offshore Operators Committee (OOC)

Comment 26 (CWIS Monitoring Requirements in Part I.B.12.c): OOC had several comments as discussed below.

(i) OOC requested that the permittee be allowed to request entrainment monitoring frequency reduction after the 24-month monitoring period. OOC claimed the entrainment impact would be insignificant based on the one-year study results and it would be inappropriate for EPA to take time to review the results prior to extending the monitoring requirement.

Response: Because the industry has not completed the study within the 2-year time frame prior to the current permit expiration as planned, results were not available for use in the final permit decision. To reduce the monitoring burden, a quarterly entrainment monitoring frequency will be established after submittal of the 2-year entrainment monitoring study or one year after the effective date of the permit, whichever comes first. Entrained fish samples shall be collected from cooling water after the intake screen if feasible.